

Extension Briefs for April & May

INTEGRATED PEST MANAGEMENT

S.D. MOORE

False codling moth

FCM activity continues during winter and can be facilitated by any fruit that remains on trees after harvest. Therefore, all fruit must be removed from trees after harvest, and destroyed. This winter fruit also creates a reservoir of inoculum of FCM for the following spring. What's more, fruit fly numbers could multiply on unharvested fruit. The removal of all fruit after harvest can dramatically reduce FCM levels in the next season.

The PPECB pallet inspections are a critical component of the FMS in assisting to filter out infested fruit. Therefore, packhouses must continue to implement all aspects of the FCM risk management system (FMS) for fruit destined for the EU, as diligently and accurately as possible. Grading of fruit on the packing line, for example, must be conducted as stringently as possible.

Packhouses should not hesitate to slow down the line speed, if necessary, to enable more careful scrutiny of the fruit. Additionally, a designated inspection table should preferably be installed just before the final grading and sizing of fruit. These should be equipped with excellent lighting, and staff appointed to conduct such inspections and grading must have 20/20 vision and should be properly trained and incentivised to perform at an optimum.

Red scale T.G. GROUT

Those growers who have experienced problems with red scale during the past season should consider applying narrow distillation range horticultural mineral oils, as these comprise the most IPM-compatible treatment option for red scale. The optimal period to apply this treatment is from budswell to budburst (mid-July to mid-August). The concentration to be used is dependent on the grade of the oil to be applied (generally 1.0 – 1.25% medium grade oil). When spraying oil, care must be taken to apply it as a full-cover, film wet spray. Trees to be sprayed must not be under

any stress either. Other treatments for red scale would normally be applied in August, September or after petal fall, and will be discussed in later editions of 'Extension Briefs'.



Ant control T.G. GROUT

Ants are usually indirect pests on citrus and they interfere with the behaviour of natural enemies, sometimes protecting and even transporting pest species. The winter months are well suited to control ants, before honey-dew-producing pests such as aphids increase on the spring growth flush. Trees should also be skirt-pruned to prevent branches from touching the ground later in the season, when bearing fruit.

NA-OES-PRAKTYKE P.J.R. CRONJÉ

Vir die voorkoming van na-oes fisiologiese afwykings is die korrekte produksiepraktyke – soos bemesting en besproeiing, asook snoei – uiters belangrik. Daar is egter gedurende die oes- en pakproses kritiese faktore waarop gelet moet word wat die voorkoms van skildefekte, asook algemene vrugkwaliteit kan beïnvloed. Bepaal die optimum plukvenster vir elke kultivar per boord deur h maand voor die beplande oesdatum met rypheidsindeksering (interne kwaliteit en skilkleur) te begin. Daar moet gepoog word om die temperatuurlading op die vrug te beperk vanaf die plukproses tot in die pakhuis, deur die vrugte se velhitte so gou as moontlik te verwyder (bv. deur vrugte gouer te "drench"). Die paklyn het beslis h invloed op skiltoestand, asook die voorkoms van skildefekte, en dit is belangrik dat alle bewegende dele, bv. rollers en borsels, asook waks-tipe en aanwending noukeurig ondersoek word.

Ontgroening is h belangrike aspek van die sitrus na-oes-hantering en moet optimaal bestuur word. Bewustheid rondom interaksie tussen kultivar, vrugrypheid en die effektiwiteit van ontgroening is belangrik. As vrugte te vroeg (onvoldoende kleur-ontwikkeling aan boom) in die ontgroeningskamer geplaas word, sal die gewenste kleur nie ontwikkel nie, en vrugte neig dan om h geler of bleker voorkoms te kry. Gedurende ontgroening is daar egter aspekte wat streng beheer moet word, nl. etileen konsentrasie (1-3 ppm), temperatuur en relatiewe humiditeit (95%+).

OPTIMUM ONTGROENINGSTEMPERATURE:

Satsuma-mandaryne	18 tot 21°C
Clementine-en Nova-mandaryne	19 tot 22°C
Nawellemoene	21 tot 23°C
Ander lemoene	23 tot 24°C
Pomelos en suurlemoene	24 tot 25°C

Ontgroen altyd meer sensitiewe vrugte teen die laagste tempera-



J.J. BESTER



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W. MOMMSEN

tuur. Die etileenbehandeling is die effektiëfste as vrugte van dieselfde kleur gelykertyd behandel word. Die tydperk van die behandeling moet ook so kort as moontlik wees. Hou die CO² vlakke onder 0.3% (3000 dpm) deur die ventilasie sodanig te stel; hoë CO² vlakke verleng die ontgroeningsproses deur as kompeterende inhibeerder teen etileen op te tree. 'n Stadiger ontgroeningstempo sal 'n verlenging van die tyd in die ontgroeningskamer vereis en 'n verkorte rakleef tyd tot gevolg hê. Vir meer inligting raadpleeg die *Common Defects Associated with Degreening of Citrus* deur Krajewski en Pittaway, wat vanaf CRI in Nelspruit bestel kan word (kontak Bella 013 759 8000).

Die koueketting se invloed op die vrugkwaliteit is van kardinale belang en sal nie net die voorkoms van skildefekte beïnvloed nie, maar ook algemene kwaliteitsaspekte soos vrugfermheid en rakleef tyd. Die belangrikste faset van die koueketting is dat dit nie onderbreek mag word nie, m.a.w. as vrugte tot op die gewenste temperatuur verkoel is, mag die temperatuur nie weer styg nie.

CROP AND FRUIT QUALITY MANAGEMENT

P.J.R. CRONJÉ

MATURITY INDEXING: Maturity indexing is done to predict the rate of change in fruit maturity, in order to harvest fruit at an optimal maturity. 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.

Random sampling of fruit every week from each of ten 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, the sugar:acid ratio calculated and fruit colour read from a colour chart. All the parameters mentioned above should be plotted on a graph over time. Once plotted, trends will become apparent, harvest dates can then be estimated and problem areas in internal and external quality parameters can be identified and manipulated.

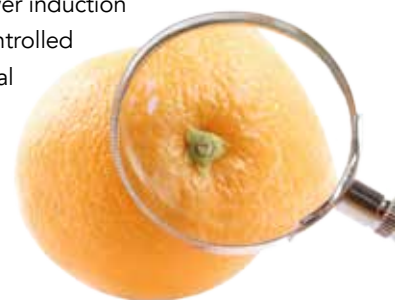
DEGREENING & POSTHARVEST RIND DISORDERS: The two publications; *Common Defects Associated with Degreening of Citrus* by Andy Krajewski & Tim Pittaway, and *Postharvest Rind Disorders of Citrus Fruit* by Paul J. R. Cronjé are strongly recommended reading for any grower. Both are available from CRI (contact Bella Thulare 013 759 8000, bella@cri.co.za).

PICKERS TRAINING AND MONITORING: 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. Picking bags should never contain leaves, shoots or sand and must be kept dry throughout. To avoid lesions on fruit, finger nails of pickers should be short and scissors and ladders handled correctly, i.e. no long stems, with limited contact between ladders and fruit. Picking of low-hanging fruit, as well as collecting fallen fruit should be avoided. Two sorters wearing gloves are to be stationed at each bin, and the fruit quality from each picker needs to be monitored by an appointed team leader via the sorters.

PRUNING: Pruning for early and mid-season cultivars should be done as soon after harvest as possible. All of the following should be removed during pruning: old, broken and dead shoots/ twigs; weak and entangled shoots crossing each other or hanging downwards; and any rootstock regrowth, water shoots and excessive regrowth from main frame shoots on the inside of the tree. Light levels of above 30% of full sunlight are necessary for optimal photosynthesis – at least one “window” cut should be made to allow adequate light distribution and improve bearing wood. An increase in photosynthesis and light distribution will lead to increased fruit size and internal fruit quality (Brix[°]), better fruit colour development, increased rind integrity, as well as a more uniform fruit distribution across the tree. Pruning can also be used as a thinning technique: prune more heavily after a light crop if a heavy crop is expected, and when the orchard has a history of alternate bearing.

Follow-up pruning of regrowth in the summer is of critical importance. Pruning also ensures better spray penetration during pest and disease control, which makes for much more cost-effective spraying. Pruning tools should always be sanitised in a water solution with 10% Jik, when moving from one orchard to another.

FLOWER INDUCTION: Citrus trees require a rest period of about six weeks to ensure that adequate flower induction takes place. Low temperatures and controlled drought stress are important for optimal floral induction in citrus, to ensure no root activity. In the absence of low-temperature rest, citrus trees should be exposed to controlled-drought stress for a 4-6 week period during June and July, if possible.



BEMESTING/ FERTILISATION

P.J. RAATH & J.G.K. COETZEE

Blaarontleding/Leaf analysis

The very last opportunity to get leaf analyses done is in June and July. Leaf analysis is still the best diagnostic method to determine the nutritional status of the trees.

Blaaranalise kan egter nie as die enigste norm vir die daarstelling van 'n bemestingsprogram gebruik word nie, maar moet as 'n aanvulling tot grondanalises gesien word. Dit is ook nuttig in gevallestudies waar blare vanaf 'siek' bome gemonster word, asook vanaf naburige, nie-geaffekteerde bome. Die gesonde/ beter bome se blare dien dan as direkte kontrole, sodat die tyd van monsterneming en al die ander veranderlikes, minder krities, of selfs nie ter sake is nie. Geen norm word gebruik nie, maar wel die relatiewe verskille tussen die twee monsters.

Grondontledings/Soil analyses

Soil analyses should be done annually and preferably during the same time as leaf analyses. A good practice is to take soil samples from the same spot every year, to ensure that an accurate historic dataset is developed for the soils. Sampling areas can be marked with GPS coordinates. Sections where trees are performing poorly should be sampled separately.

Gereelde grondontledings word benodig in bestaande boorde om te verseker dat optimale groeitoestande gehandhaaf word. Die belangrikste voordeel van grondontledings in bestaande boorde is dat veranderings in grondvrugbaarheid bespeur kan word en korrekatief opgetree kan word, voor voedingsprobleme wat boomprestasie benadeel, kan ontwikkel.

Other analyses

If manure or compost is used, it should be analysed to determine the nutrient value and occurrence of unacceptable elements (e.g. heavy metals) in the organic material. The amount of organic material applied is determined by the concentration of nutrients in the compost or manure. The nutrient content of organic material is much lower than inorganic fertilisers, and is often in an inappropriate ratio, compared to what the trees' nutritional requirement is. Therefore, be careful not to apply excessive amounts of nutrients that are out of sync with the tree's requirement.

Bemesting/Fertilisation

Potential yield is used as an indicator for the amount of fertiliser to be applied. Use historic yield data to determine a realistic target yield and basis from which the fertilisation requirement is compiled. The fertilisation programme should then be tweaked using results of both soil and leaf analyses.

Element	Mikrospruite/Micro-sprinklers
N	Dien die meeste N gedurende Julie tot September toe. Die aantal toedienings word bepaal deur die totale massa kunsmis wat toegedien moet word en die klei-inhoud van die grond. Die beginsel vir sproeibemesting of hand- en meganiese toediening bly dieselfde.
Organiese materiaal	Organiese materiaal soos kompos, kraal- of hoendermis moet nie later as Julie of Augustus toegedien word nie. Vrystelling van N uit organiese materiaal is moeilik om te beheer en oormatige N-mineralisasie na Oktober sal nadelige gevolge inhou.
P	Use single or double superphosphate. In higher pH soils it should be applied in a narrow strip of about 5 cm wide in the wetted zone.
K	Wanneer sproeibemesting gebruik word, kan korrektiewe bemesting op swaarder gronde teen 100 g K per boom per toediening, oor die hele lengte van die siklus toegedien word. Doen dit elke twee to drie weke totdat die voorgeskrewe aanbeveling toegedien is. Wanneer meganiese of met die hand uitgestrooi word, word die aanbevole K in een (leem- tot kleigronde) tot drie (sandgronde) toedienings gedurende die lente/vroeë somer gemaak.
Ca	Calcium deficiency is only expected in acidic or extremely sandy soils. The most critical time to avoid a deficiency is from August to October. Lime applications should, therefore be done in winter, while gypsum can be applied up to August or September
Magnesium	Dolomitiese kalk, magnesiumsulfaat of -hidroksied of -oksied kan in die lente, vroeë somer of herfs toegedien word.
Sulphur	Sulphur deficiency has the most devastating effect on fruit set. Where a deficiency is present, apply the sulphate (e.g. gypsum) during July to August. On sandy soils, maintenance applications are done during spring or early summer.

The fertilisation programme for each season starts in July or August of the previous year, depending on the production area. Due to the properties of the specific chemical ion, the properties of the soil and the physiological requirements of the trees, certain basic rules should be adhered to when applying fertilisers to citrus.

Blaarbespuitings word gebruik om tekorte reg te stel of om die bome se fisiologie te manipuleer. Vir manipulasie is dit hoofsaaklik lae biuret ureum of kaliumnitraat wat gebruik word. Indien nodig, moet beide bespuitings ses tot agt weke voor die 50% blomstadium toegedien word. Dit is gewoonlik in Julie of vroeg in Augustus.

Element	Timing	
N	Low biuret urea to stimulate blossom or improve the quality of the blossom.	July or early August
	Low biuret urea to supplement the nitrogen supply.	October to February
P	Om die suur-inhoud van die vrugte te verminder. Om die TOV van die vrugte te verhoog. Om dunner en gladder skille te gee.	Ses weke na blomblaarval; ses, vier en twee weke voor oes.
K	Potassium nitrate to stimulate blossom or improve the quality of the blossom.	July or early August
	Potassium sulphate to supplement the K supply, if root uptake is insufficient.	August/September for the best results and up to February for maintenance.
	Potassium nitrate to supplement the K supply, if root uptake is insufficient.	After fruit drop, to December
Mg, Zn, Mn, B en Mo	Waar h tekort ondervind word Instandhouding, indien nodig	Julie/Augustus en weer in Oktober. Oktober tot Desember
Cu	Only recommended to correct a deficiency	May to July, before flowering.

Druppers/Drippers

Die beginsel is soos dié vir mikrospruite, maar die massa word verdeel in 'n groot aantal toedienings wat tot Desember strek. Die meeste N moet egter nog steeds in Julie tot September toegedien word, en die toedienings moet nie veel later as Januarie aanhou nie.

Die huidige metode is om die totale massa organiese materiaal te verdeel en gelyke massas bo-op elke drupper te plaas. Dit moet op die laatste teen Julie/Augustus gedoen word.

Use a water soluble source like mono ammonium phosphate (MAP). In high pH soil, phosphoric acid can be used, which should be applied in a few instalments over four to five months, from spring onwards.

Dien die aanbevole massa kaliumnitraat, -sulfaat of -chloried oor 'n periode van drie tot ses maande gedurende Julie tot Desember toe.

In addition to lime and gypsum, which require rain to be washed into the soil, calcium nitrate is the only suitable alternative source. It must be applied from July to September/October, and can be extended to December. Take the nitrate component of the calcium nitrate into account when calculating N fertilisation.

Magnesiumnitraat of -sulfaat word ook oor 'n periode van drie tot ses maande toegedien. Die nitraat word gewoonlik vroeg toegedien, en die sulfaat na Oktober.

Gypsum, applied in the rainy season. Otherwise, magnesium, potassium or ammonium sulphate are S-sources and the application is timed to fit the requirement of these four elements.



POSTHARVEST PATHOLOGY

DU PLOOY & L. MAMBA

Most packhouses are now entering their peak period, therefore important and basic practices such as sanitation and fungicide application must not be neglected.

Packhouse sanitation

This is mainly:

1. to remove any infected fruit from the packhouse environment
2. to sanitise surfaces with appropriate treatments.

These actions will reduce the inoculum (spore) levels, and the risk of future infections and fungicide resistance development.

SURFACES THAT SHOULD BE CONSIDERED IN SANITATION:

- **Packline surface** – treat *daily* with QAC and rinse with clean water afterwards; alternatively use chlorine or SOPP.
- **Fruit surface** – one of the *first* steps, when entering the packhouse, should be a fruit disinfectant treatment (chlorine is the most popular active for this step). Remember to manage the Cl concentration, pH and ORP. Suitable alternatives such as liquid or powder PAA formulations can also be used, with the precaution that the PAA levels must be managed carefully. When PAA is present, there's no need to adjust the pH.
- **Floors and walls** – wash *weekly* with a registered quaternary ammonium compound (QAC), or a registered soap. These include the packhouse, degreening rooms and cold rooms.
- **Degreening rooms and cold rooms** - need to be washed and then, where possible, fumigated with a suitable product that can reach into crevices and folds.
- **Orchard bins and picking bags** – wash regularly.

Sources of inoculum (spores)

- **Waste fruit** – have protocol in place to remove this fruit a.s.a.p. and to keep it in sealed containers.
- **Juice fruit** – this fruit is often treated with fungicides, and sits in the packhouse area for some time until it's shipped to the juicing plant. Any decay that develops in such fruit presents a resistance risk.
- **Retention samples** – fruit that was also treated with fungicides, and bears a similar resistance risk as above.
- **Post-degreening fruit** – degreening conditions are hugely favourable for disease development and unfortunately, some sporulating fruit are often tipped into the packhouse system.



Recommendations that can reduce the risk of infection and/or resistance development

- Treat all harvested fruit a.s.a.p., but within 12-18 hours, as most fungicides cannot control infections older than a day. This is now more important than ever with the loss of guazatine.
- Don't let fruit stand from Friday afternoon to Monday morning without any fungicide protection. In this case it would be prudent to drench the fruit on Friday.
- Degreeen fruit for the absolute minimum period of time
- Do not exceed the volume limit of your packline: exceeding the limit will result in accelerated agitation and movement of the fruit, which, in turn, will result in bruising and injuries, and will reduce the efficacy of sanitation and fungicide treatment. Fruit will move too quickly through the various control points:

- o The chlorine treatment = poor disinfection, spores surviving
 - o The fungicide dip tank = loading suboptimal residue, poor infection control
 - o The wax applicator = poor wax deposition on the fruit = suboptimal residue loading, poor moisture retention, negative impact on quality
- Limit the time from harvest to pack and eventual introduction to the cold chain.

Managing retention fruit

- Have a dedicated person managing this task
- Fruit should be evaluated every day, and decayed fruit noted on the carton and removed
 - o This infected fruit should be placed in a plastic bag immediately, and the bag sealed tightly, to reduce the risk of releasing inoculum (spores) into the packhouse atmosphere
 - o Fruit in retention samples have been treated with fungicides, and holds a serious resistance risk if spores are spread into the packhouse
 - o Green mould sporulation inhibition is a very important criterion to note, as the loss of sporulation inhibition is indicative of either fungicide resistance or poor fungicide application. To prevent spores spreading from these infected fruit, fruit that exhibit sporulation inhibition should be kept in sealed transparent plastic bags and incubated for another week to rate sporulation inhibition.
 - o When the sporulation inhibition rating is concluded, the bagged fruit must be destroyed (along with the bag), well away from citrus orchards and packhouses to prevent spores from entering any production area.
- Do not keep fruit for longer than the shipping period

Ideally, the retention room should be some distance away from the clean area in the packhouse, and should be totally enclosed with controlled access. This room should be cleaned and treated with a suitable soap and sanitiser, at least once a month.

