

CITRUS RESEARCH

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INTEGRATED PEST MANAGEMENT

False codling moth S.D. MOORE

All fruit remaining on orange, mandarin and grapefruit trees (i.e. all FCM susceptible cultivars) after harvest must be removed and destroyed. This is because FCM activity does not cease during winter and any remaining fruit can therefore serve to facilitate this activity. In addition, this winter fruit creates a reservoir of inoculum of FCM for the following spring. Conversely, removal of all fruit after harvest can dramatically reduce FCM levels in the following season. In addition, fruit fly numbers can also build up on unharvested fruit.

Red scale T.G. GROUT

Those growers who have experienced red scale problems during the past season should consider applying narrow distillation range horticultural mineral oils. Although the oil price is higher than it used to be, oil is probably the most IPM-compatible treatment option for red scale. The generally accepted 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 the oil as a full cover, film wet spray. This is because oil suffocates the insect, a job it cannot do if the scale is not covered with oil. Trees to be sprayed must also not be under any stress. Other treatments for red scale would normally be applied in August, September or after petal fall and will be discussed in the next edition of Extension Briefs.

Ant control T.G. GROUT

Ants are usually indirect pests on citrus and interfere with the behaviour of natural enemies, sometimes protecting and even transporting pest species. The winter months are a good time to control ants before honeydew-producing pests such as aphids increase on the spring growth flush. If trunk barriers are being used as a control method they should be replaced or rejuvenated at this time and trees should be skirt-pruned to prevent branches from touching the ground later in the season when bearing fruit.

NA-OES PRAKTYKE P.J.R. CRONJÈ

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 pak-proses kritiese faktore waarop gelet moet word wat die voorkoms van skildefekte, asook algemene vrugkwaliteit kan beïnvloed. Bepaal die optimum plukvenster vir elke kultivar per area deur 'n maand voor die beplande oesdatum met rypheidindeksering (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 veldhitte so gou as moontlik te verwyder (bv. deur vrugte gouer te "drench"). Die paklyn het 'n invloed op skilkondisie, asook die voorkoms van skildefekte, en dit is belangrik dat detail aandag aan alle bewegende dele, bv. rollers en borsels, asook waks-tipe en aanwending geskenk word.

Ontgroening is 'n belangrike aspek van die sitrus na-oes hantering en moet optimaal bestuur word. Dis belangrik om te besef dat daar 'n interaksie tussen kultivar, vrugrypheid en die effektiwiteit van ontgroening bestaan. As vrugte te vroeg (onvoldoende kleurontwikkeling aan boom) in die ontgroeningkamer geplaas word, sal die verlangde kleur nie ontwikkel nie. Gedurende ontgroening is daar egter aspekte wat streng beheer moet word, nl. etileenkonsentrasie (1-3 ppm), temperatuur en relatiewe humiditeit (95%+).

Optimum ontgroeningstemperatuur	
Satsuma mandaryne	18 tot 21°C
Clementine en Nova mandaryne	19 tot 22°C
Nawel lemoene	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 temperatuur. Die etileenbehandeling is die effektiefste as vrugte van dieselfde kleur te gelykertyd behandel word. Die tydperk van die behandeling moet ook so kort as moontlik wees. Hou die CO_2 vlakke onder 0.3% (3000 dpm) deur die ventilasie sodanig te stel; hoë CO_2 vlakke verlangsaam 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 rakleeftyd tot gevolg hê. Vir meer informasie raadpleeg die "Common defects associated with degreening of citrus" deur Krajewski en Pittaway, wat bestel kan word van CRI in Nelspruit (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 rakleeftyd. Die belangrikste faset van die koueketting is dat dit nie onderbreek mag word nie, m.a.w. as vrugte tot op die verlange temperatuur verkoel is, mag die tempertuur nie weer styg nie.

CROP AND FRUIT QUALITY MANAGEMENT

J.S. VERREYNNE

Maturity indexing Maturity indexing on mid-season to late cultivars should commence. 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 comparison. 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 the parameters mentioned above should be plotted on a graph over time. Once plotted, trends will become apparent, harvest dates can be estimated and problem areas in internal and external quality parameters can be identified and manipulated.

Degreening and post-harvest rind disorders The two publications "Common Defects Associated with Degreening of Citrus" by Andy Krajewski and Tim Pittaway and "Post-harvest 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 Pruning for the earlier and mid-season cultivars should be done during this period as soon as possible after harvest. Prune heavier 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 inside the tree and improves the quality of the bearing wood inside the tree. Pruning can also be used as a thinning technique. Light levels above 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 can drop below this threshold level in the inside of the tree and adversely affect fruit size.

Flower induction: Citrus trees require a rest period of about 6 weeks to ensure that adequate flower induction takes place. The two mechanisms involved in floral induction in citrus involve (i) low temperature, or (ii) controlled-drought stress, both to ensure no root activity. In the absence of low-temperature rest, citrus trees should be exposed to controlled-drought stress for a 4 to 6 week period during June and July if possible.

BEMESTING / FERTILISATION

J.T. VAHRMEIJER AND 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 measure the nutritional status of the trees.

Grondontledings/Soil Analyses Soil analyses should be done anually 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.

Other analyses If manure or compost is used as a fertiliser source, then the material should be analysed to determine the nutrient value of the organic material. The amount of organic material applied is determined by the amount of nutrients that is available in the compost or manure. Normally the nutrient content of organic material is much lower than inorganic fertilsers and therefore high quantities of organic material are applied. Be careful that excessive nutrients or toxic amounts of other elements are not applied.

Bemesting/Fertilisation The fertilisation programme is compiled from results of both soil and leaf analyses. 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.

The fertilisation programme for the 2013 crop starts in July or August 2012, depending on the production area, and is usually completed by November (where micro-sprinklers are used) or January (where drippers are used). 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. See table on page 66.

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. Beide bespuitings moet 6 tot 8 weke voor die 50% blom-stadium toegedien word. Dit is meestal Julie of vroeg Augustus.

	Element	Timing
N	Low biuret urea to improve the quality of the blossom. Low biuret urea to supplement the nitrogen supply.	July or early August October to February
P	Om die suur-inhoud van die vrugte te verminder. Om die TOV van die vrugte te verhoog.	6 weke na blom-blaar-val. 6, 4 en 2 weke voor oes.
K	Potassium nitrate to improve the quality of the blossom. Potassium sulphate to supplement the K supply. Potassium nitrate to supplement the K supply.	July or early August August/September for the best results and up to February for maintenance. After fruit drop to December
Mg, Zn, Mn, B en Mo	Waar 'n tekort ondervind word. Instandhouding.	Julie en weer in Oktober. Oktober tot Desember
Cu	Usually only recommended to correct a deficiency.	May to July, before flowering.

POST-HARVEST PATHOLOGY WASTE PREVENTION CHECKLIST

K.H. LESAR and A. ERASMUS

Intermittent rainfall already experienced in the summer rainfall production areas and possible heavy rain in the winter rainfall production areas during the 2012 packing season could lead to the following problems:

- high pathogen inoculum levels in orchards on all surfaces resulting in
- infections by latent pathogens – Anthracnose, Diplodia and Phomopsis stem-end rot

Element	Mikrospuite/Micro-sprinklers	Druppers/Drippers
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 meganiesetoediening bly dieselfde.	Die beginsel is soos dié vir mikrospuite 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 langer as Januarie aanhou nie.
Organiese materiaal	Dien al die organiese materiaal soos kompos, kraal- of hoendermis gedurende Julie tot Augustus toe. Genoeg tyd moet gelaat word sodat 70% van die stikstof teen Oktober vrygestel is.	Die huidige metode is om die totale massa organiese materiaal te verdeel en gelyke massas bo-op elke drupper te plaas. Dit moet gedurende Julie/Augustus gedoen word.
P	Use only single or double supers and apply it in a narrow strip of about 5 cm wide, below the drip line of the trees.	Use a water soluble source like mono ammonium phosphate (MAP) or phosphoric acid and apply it over an extended period (4 to 5 months) at lowish concentrations.
K	Wanneer sproeibemesting gebruik word, kan dit teen 100 g K per boom per toediening oor die hele lengte van die siklus toegedien word. Wanneer meganies of met die hand uitgestrooi word, word een (leem- tot kleigronde) tot drie (sandgronde) toedienings gedurende die lente/vroeë somer gemaak.	Dien die aanbevole massa kaliumnitraat, -sulfaat of –chloried oor `n periode van 3 tot 6 maande gedurende Julie tot Desember toe.
Ca	The most critical time for a deficiency would be August to October. Therefore when gypsum is required, apply it during August or September.	Calcium nitrate is the only suitable source and must be applied during August or even July to September/October. The application can however be extended to December. Remember to take into account the nitrate component of the calcium nitrate when calculating N fertilsation.
Magnesium	Dolomitiese kalk, magnesium-hidroksied of –oksied kan in die lente, vroeë somer of herfs toegedien word.	Magnesiumnitraat of –sulfaat word ook oor `n periode van 3 tot 6 maande toegedien. Die nitraat word gewoonlik vroeg en die sulfaat na Oktober toegedien.
Sulphur	Sulphur deficiency has the most devastating effect on fruit set. Where a deficiency is present, apply the sulphate during July to August. Maintenance applications are done during spring or early summer.	Magnesium-, potassium or ammonium sulphate are the sources and the application is timed to fit the requirement of these four elements.

fruit journal

• infections by wound pathogens – green and blue mould and sour rot
• infections by soil pathogens – Phytophthora brown rot, sour rot, Trichoderma and Fusarium

Precautions and Recommendations

• Minimise injuries to fruit during picking, handling and transport to pack house.
• Handle the fruit as a perishable product, because it is a perishable product.
• Ongoing removal of dead wood from trees.
• Ongoing 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.
• Packed fruit must be cooled down as soon as possible.

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 discard or sell on the local market.

Spray contact fungicides only (copper at 200 g / 100 *l* or Dithane at 200 g / 100 *l*) as a preventive measure against Phytophthora brown rot. Contact fungicides must be resprayed after any follow-up rainfall.

The registered foliar applications of phosphonates for the control of Root and Collar rot will also be effective against brown rot whereas phosphonate stem treatments and soil applications will not control brown rot. Brilliant, which is an ammonium phosphonate, is registered as a foliar application against brown rot.

RECOMMENDATIONS TO PACKHOUSES THAT ARE STILL DEGREENING

Pick selectively for degreening. Place only fruit that has reached colour break into the same crates, and not fruit of different colours in the same crate.

Drench with recommended mixture within 24 hours.

Fruit must not spend too long in degreening (preferably not longer than 48 hrs; maximum 72 hrs).

Extended time in degreening predisposes fruit to poor quality and waste. **NB** ***do not dump wasty fruit (especially green and blue mould and sour rot), found in bins after degreening, into pack house washing systems. Pre-sort and remove this infected fruit before the fruit moves into the pack house.***

Pesticide mixtures and incompatibility

TIM G GROUT *Citrus Research International, Nelspruit*

There is increasing pressure on farmers and pesticide applicators to combine several chemicals in the spray tank in order to save on application and carbon costs and reduce soil compaction. Granular formulations are also becoming more popular as manufacturers move away from emulsifiable concentrates (ECs) and these are not always mixed correctly. Few labels of plant protection products will state that the chemical is compatible with other chemicals unless these specific mixtures have been tested and proved to be compatible by the registration holder. More often it is left to the farmer to find out by trial and error whether certain mixtures are compatible or whether they could even be phytotoxic. For at least 50 years people have advocated the use of a "jar test" to determine whether certain mixtures of chemicals are compatible. However, this only tests physical compatibility and will not demonstrate whether two products are chemically or biologically incompatible or antagonistic; this may only be noticed by reduced efficacy or phytotoxicity and will require testing on a small number of plants having the target organism.

A jar test is useful in eliminating certain pesticide mixtures that are obviously incompatible and it can be conducted with the use of a 500 ml or 1 L clear, glass jar with a lid. The chemicals to be tested should be combined in approximately the same proportions that they would be used in 100 L water. The water used in the test must be from the same source that will be used for spraying. Disposable syringes can be used to measure the small quantities of liquid pesticides required but when EC formulations are used the syringes may not last very long. Small quantities of powders are more difficult to measure but a quarter teaspoon will be approximately 0.5 g so this will be equivalent to 50 g per 100 L water. The chemicals should be added in the order given below and the jar shaken with the lid in place between each addition. If the liquid warms up it is an indication of incompatibility. After all the chemicals have been added and the jar shaken it should be left for about two hours to see whether there is any settling out of solids, floating sludge or a change in consistency. These would all indicate physical incompatibility.

There is some variance in the recommended order of adding chemicals to a tank mix. Everyone is agreed that the tank should first be at least half full of water and that any conditioning of the water such as acidification must be done first. The first products to be added are then wettable powders and water dispersible granules followed by flowables and suspensions, but there is some debate about whether ECs should be added next or last, after soluble powders, liquids and adjuvants.

The following order appears to be the most preferred and I have made up a mnemonic to help remember it:

A is to acidify where necessary
W is for wettable powders, water dispersible granules and white liquids (flowables and SCs)
A is to agitate well before adding anything else
S is for soluble liquids and powders
A is for adjuvants and surfactants
O is for oils
E is for ECs

Recommendations to pack houses that are not degreening

OPTION: Drench with STANDARD MIXTURE within 24 hours and allow bins to stand for 1-2 days before packing.

Remove wasty fruit in bins. Do not dump wasty fruit into pack house washing systems.

Ethephon (Ethrel) application on export fruit in the pack house

NB!! A change to the citrus Ethephon EU MRL (now 0.05 mg/kg) and a revised Ethephon residue testing methodology are recent developments producers using Ethephon (Ethrel) should note.

The recommended restrictions that apply are as follows:

NOT PERMITTED: EU, USA, Japan (post-harvest) and other markets, except where other restrictions apply.

PERMITTED: Canada, Middle East and Indonesia

REFER: Cutting Edge/Snykant no. 84 and "Recommended Usage Restrictions" September 2011.

In the markets where Ethephon/Ethrel is permitted, those pack houses that do not have access to ethylene gas degreening can easily, cheaply and effectively apply Ethrel in the pack house. One major drawback with this application is that relatively green fruit cannot be easily graded out for blemishes.

The colour should shift by 1 or 2 colour plates after treatment and packing if the fruit stands within the confines of the packhouse at a temperature range of 18-25°C or higher for a day or two prior to going into cold storage. Colour development will continue slowly after cold storage.

The application is applied on the pack house line before waxing as a total loss spray over a set of brushes. Ensure that the brushes are adequately wet to ensure good coverage of the fruit.

The Ethrel is applied as follows:

156 ml Ethrel / 25 *l* water for lemons, grapefruit and Clementines (3 000 ppm).

210 ml Ethrel / 25 *l* water for oranges (4 000 ppm).

plus 2.5 ml Agral 90.

NB. 2,4-D Deccomone (250 ml/25 *l* water) must be used when applying Ethrel. Fruit must be dry before waxing.

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