

EXTENSION BRIEFS

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Citrus Research International



INTEGRATED PEST MANAGEMENT

T.G. GROUT

Thrips management

During October and November, citrus fruit are highly susceptible to damage from citrus thrips and orchards should be scouted at least once a week for this pest. This scouting should include looking under the sepals. Citrus thrips larvae cause more serious damage than adult thrips so low numbers of adults in the absence of larvae may not require immediate intervention. The intervention threshold for citrus thrips larvae is 2% for the first four weeks after petal fall, 3% for five to six weeks after petal fall, then 4% for seven to eight weeks after petal fall. These thresholds can be approximately doubled if the population comprises mostly adults. If thripicide treatments are required, use products suited to both the thrips population density and the spray machinery available for reapplication at short notice. The use of dedicated spray machines for the rapid application of thrips baits prevents clashes with black spot and red scale spray programmes. Citrus thrips are genetically predisposed towards developing resistance to pesticides so avoid spraying two consecutive sprays of the same active ingredient.

S.D. MOORE

Parasitoid releases

Growers planning to augment parasitoids for control of red scale, mealybug or false codling moth should initiate releases as early in the new season as possible. Augmentative releases of parasitoids are not a corrective option, and growers should therefore not wait until the pest reaches a problematic level. Research trials with mealybug and FCM parasitoids indicate that better suppression of the pest is achieved with releases initiated as early as October.

Preventative sprays for mealybug

Pre-harvest blemish analyses or winter inspections of trees might have indicated that preventative spraying for mealybug is unnecessary. This can be confirmed or refuted by inspecting fruit in October and November for the presence of mealybug. Sprays applied before calyx closure will most likely be more effective than those applied thereafter. An infestation level in excess of approximately 5% at petal fall, up to 20% six weeks after petal fall, indicates the need for immediate chemical intervention. Anything short of an absolutely thorough full cover film spray will compromise the effectiveness of a chemical treatment.

It appears that the biocontrol complexes of oleander mealybug and longtailed mealybug, in particular, may not be as effective as that of citrus mealybug. Therefore, more conservative

treatment thresholds can be used when either of these species are identified as the dominant species in a particular orchard. If citrus mealybug is not

the dominant species, augmentative releases of *Coccidoxenoides perminutus* should be considered unsuitable.

J.H. HOFMEYR

Valskodlingmot

Dit is teen dié tyd algemene kennis dat geen enkele bestrydingsmaatreël werklik teen VKM doeltreffend is nie. Produsente moet daarom van 'n multidissiplinêre strategie gebruik maak. Dit beteken dat alle maatreëls wat 'n produsent kan bekostig, saam gebruik moet word om VKM die beste te onderdruk. Meer as een van die maatreëls, soos boordsanitasie, loslatings van die eierparasitoïed *Trichogrammatoidea cryptophlebiae*, paringsontwrigting en bespuiting met 'n geregistreerde insekdoder kort voor oestyd, behoort saam gebruik te word.

Boordsanitasie speel in dié opsig 'n belangrike rol, aangesien dit kan help dat VKM-bevolkingsgetalle van vroeg in die seisoen af onderdruk word. Dit kan daartoe lei dat die uiteindelijke bevolking baie kleiner is as wat dit in die afwesigheid van boordsanitasie sou gewees het. Boordsanitasie moet vroeg begin aangesien VKM alreeds tertjie-grootte vrugte kan besmet. Alhoewel slegs 'n klein persentasie van sulke vruggies deur VKM besmet word, val daar tienduiseende vruggies van die bome in die vrugspeentydperk af. Groot getalle motte kan daarom potensieel daaruit ontwikkel. Boordsanitasie moet deeglik tot na die einde van die seisoen uitgevoer word en nie in oestyd afgeskeep word nie. Na oestyd moet alle buiteseisoen vrugte ook afgepluk en vernietig word.

Volledige aanbevelings vir boordsanitasie word in die Rigglyne vir Sitrusproduksie Deel III (Geïntegreerde Plaag- en Siektebestuur), verstrek.

CROP LOAD AND FRUIT QUALITY MANAGEMENT

J.S. VERREYNNE, G.H. BARRY

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 previous crop load. Moisture stress should be avoided during full bloom, fruit set and early fruit growth.

The acidity of fruit at harvest is largely determined within a few weeks of fruit growth and development. Thereafter, only minor modifications to acidity can be achieved. Under conditions of anticipated high acidity at harvest, calcium arsenate can be applied approximately 6 weeks after full bloom. Specific concentrations for various cultivars can be found in the Production Guidelines for Export Citrus. However, depending on target

market, growers should only apply this product where permitted by the importing country. Alternative products that have a lesser effect on acid reduction include mono-ammonium phosphate (MAP) and mono-potassium phosphate (MKP) applied at 1%, i.e. 1 kg per 100 litres of water, 6 weeks after full bloom. Please note that these phosphate sources have not been tested on all citrus cultivars; until now 1% MAP or MKP have reduced acidity on Valencia orange and Temple tangor, but not on grapefruit. A higher concentration, e.g. 5%, has worked well in Israel.

Pruning of late cultivars should be done during this period as soon as possible after harvest. Pruning 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. Prune heavier after a light crop if a heavy crop is expected and when the orchard has a history of alternate bearing. 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% in the inside of the tree and adversely affects fruit size.

Regrowth control, especially after heavy pruning earlier in the season, should commence. A lot of regrowth adversely affects

fruit size and is antagonistic to fruit colour development, especially for early maturing cultivars.

FRUIT SIZE AND FRUIT GROWTH

Normally, fruit in the small fruit counts of almost all the varieties does not even cover the production and packing costs and the income on small fruit almost always results in a loss. That means that the profit made on peak counts subsidize the loss made on small fruit counts. An individual factor or a combination of factors may be responsible for small fruit. Below are a few controllable factors that can be manipulated to improve fruit size. However, all the factors influencing fruit size should be considered and managed optimally.

Irrigation: Fruit growth must be optimised during stage 1 (cell division) of fruit development. Optimal nutrition and irrigation practices are required to stimulate cell division. Moisture stress should be avoided during full bloom and early fruit growth. Moisture stress during phase II (starting $\pm$ 60 days after full bloom) of fruit growth results in smaller fruit. Faster and more uniform fruit growth results from more frequent short cycle irri-



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gation compared to long cycle irrigation.

Fertilisation: Leaf N:K ratio is important for fruit size and should be between 1.6 and 2.2. Low K levels will influence fruit size negatively. KNO₃ foliar application should not be applied with Corasil E®/Maxim®. Avoid nitrogen fertilisation after December.

Tree and root health: Any factor inhibiting water uptake and transport in a plant will have an adverse effect on fruit size. Tristeza, greening disease and blight can adversely affect tree health which will result in small fruit. Control of nematodes and Phytophthora, especially if it causes a lot of root damage, can improve fruit size.

Delaying harvest: Although fruit grow very slowly during phase III of fruit development, delaying harvest and selective harvest of larger fruit can result in a fruit size improvement. Delaying harvest, however, improves the possibility of the development of creasing and has an adverse effect on the floral intensity of the return bloom which can result in alternate bearing.

Summer girdling: Summer girdling in combination with some of the other control measures can have a positive effect on fruit size, but only if the other factors that have an adverse effect on fruit size are managed optimally.

Fruit load: Although there are a lot of controllable and non-controllable factors that play a role in fruit size, fruit load is a large contributing factor. The more fruit on a tree, the smaller the fruit are. With thinning we change the leaf:fruit ratio resulting in more leaves contributing to the growth of a single fruit. Crop reduction, especially in the "on-year" with the aim of reducing fruit-to-fruit competition and therefore improving fruit size can be accomplished by blossom thinning by pruning during bloom, flower reduction with gibberellin application the previous winter (not commonly used), hand thinning and chemical thinning with synthetic auxins. Fruit size improvement due to "overthinning" can sometimes result in a greater financial benefit than the crop reduction.

Application of Corasil E® (2,4-DP) or Maxim® (3,5,6-TPA) at an early stage (smallest diameter on product label) can thin

fruit (20-30% thinning) and improve fruit size. Early application results in more thinning and a better response. Later application (larger diameter on product label) can improve fruit size without thinning or 5-10% thinning. The timing of application (small or large diameter) is determined by the fruit set achieved, e.g. where gibberellins were applied to improve fruit set, Corasil E® or Maxim® should be used, and with a very heavy set it should be applied earlier. Be careful where heat waves and water stress can cause excessive drop of small fruit. Corasil E® or Maxim® should only be used where fruit size is a problem, with a heavy crop load that will result in small fruit and where gibberellins were applied to improve fruit set. Trees should be healthy for Corasil E® or Maxim® to have the desired effect. Application of Corasil E® or Maxim® with K foliar applications in the same season, sandy soils, rough lemon rootstocks, single drip lines and high N- and K-levels can result in granulation of fruit. Corasil E® and Maxim® have to be applied strictly according to the product label and the warnings on the product label regarding its use should be noted.

Corasil E® has a withholding period of 150 days and is recommended at 150 ml/100 l water with 15 ml Agral. If the pH of the water is >6 it should be corrected to between 4.5 and 5. Corasil E® is recommended on oranges and grapefruit according to the label after November/December fruit drop to improve fruit size without thinning. Corasil E® is, however, sometimes used on oranges and grapefruit earlier than recommended on an experimental basis to achieve thinning. Refer to the product label for the phenological stage (average fruit diameter (mm)) at which the product needs to be applied for each cultivar.

Maxim® has a withholding period of 120 days and is recommended at 1 tablet/100 l water with 20 ml Agral. If the pH of the water is >6 it should be corrected to between 4.5 and 5. Refer to the product label for the phenological stage (average fruit diameter (mm)) at which the product needs to be applied for each cultivar/selection.

Average diameter calculation to determine when Corasil E® or Maxim® should be applied can be done as follows. Select two to three representative trees per uniform block and measure the diameter of at least 50 fruit per tree. Select a part of the tree with the highest density of fruit. Measure all the fruit from small to large, but not the yellow fruit. When the average reaches the desired fruit diameter, spray immediately. Measure fruit with a caliper, preferably a digital one.

Hand thinning: Selective removal of 20-30% of fruit from heavy bearing trees (the small and blemished fruit are removed) within 21 days from the November/December fruit drop period can improve fruit size and the earlier this can be done after the November/December drop the greater the effect would be. This

is, however, a time consuming practice, but removing the small fruit, that would not attain marketable size, at an early stage would be cheaper than harvesting these small fruit with clippers at maturity.

GRONDGEDRAAGDE SIEKTES

M.C. PRETORIUS

Wortelsorg: Aalwurms en *Phytophthora*

’n Gesonde wortelstelsel is essensieel vir opbrengs, vruggrootte en algemene boomgesondheid. Onder droë toestande sal wortel probleme en simptome duideliker sigbaar wees. Daarom is dit belangrik dat alle faktore wat ’n invloed op die boom se wortelstelsel mag hê, in ag geneem behoort te word wanneer ’n aalwurmbeheerstrategie beplan word. Al die geregistreerde aalwurmdoders, Temik uitgesluit, het heelwat water nodig, minstens 40 mm, om die produkte effektief deur die grondprofiel te was om enigsins effektief te kan wees.

Probleem boorde, boorde met ’n kleinvrug- en opbrengs-probleme, behoort eerstens gemonster te word om te bepaal of aalwurmpopulasies wel bo die drempelwaarde is en of *Phytophthora* nie dalk die probleem is nie, m.a.w. alle moontlike faktore wat ’n invloed op die wortelstelsel het moet uitgeskakel

word. Besproeiingstelsels behoort gereeld nagegaan te word om sodoende optimum besproeiing te verseker. Indien die aalwurmpopulasie wel die drempelwaardes oorskry, moet die aalwurmdodertoediening volgens die effektiewe benattingsarea toegedien word. Geen aalwurmdodertoediening behoort gedoen te word indien besproeiing nie optimaal toegedien kan word op die behandelde area nie.

Monsterneming vir aalwurms kan regdeur die jaar gedoen word maar behandelingstye van besmette boorde in die verskillende reënvalgebiede sal van mekaar verskil, aangesien reënval ’n groot rol speel tydens die inwas van die middels in die grond. Geregistreerde middels kan dus nou met ses tot agt weke intervale toegedien word in die somerreënval gebiede.

Indien *Phytophthora* wortel en/of kraagvrot voorkom kan twee of drie fosfonaat blaarbespuitings of stamaanwendings volgens geregistreerde dosisse aangewend word met ses tot agt weke intervale.

Wat uiters belangrik is, is dat die voorsorgmaatreëls soos op die etiket gespesifiseer, streng nagevolg moet word. Geen boom behoort ’n blaar/stamaanwendingstoediening te ontvang indien die bome onder enige vorm van stres is nie. Die stres faktore sluit warm droë dae, onder- of oorbesproeiing, hoë temperature en warm bergwindtoestande in.

Die Joernaal vir die Vrugtebedryf in Suid-Afrika

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CITRUS BLACK SPOT

G.C. SCHUTTE

Various new control programmes consisting of copper fungicides, dithiocarbamates, benzimidazoles, strobilurins and the sanitising agent, Sporekill, were evaluated and can be recommended. Research trials with different copper formulations indicated that two or more successive applications of copper fungicides (*viz.* a:b:b:a) are the cause of stippling. If the copper fungicides are altered with mancozeb for instance, no stippling were observed (*viz.* a:b:a:b). Furthermore, research trials where mancozeb was replaced with copper in tank mixtures with strobilurins and oils, showed that it was not only effective, but that the copper and oil mixtures had no effect on the trees and it also had a cost benefit. If growers are interested in spraying such a programme where the strobilurins are applied in November and December (according to the label), then copper can only be used in one of the tank mixtures as the next treatment or successive treatment can not be

copper as it will result in copper stippling.

With regards to the dithiocarbamates, new legislation by the Canadians to limit the MRL to 0.1 ppm, will have a huge effect in the selection of fungicides to cater for this market. Currently only 2-3% of the South African growers do export to Canada and they must familiarise themselves with the restrictions and protocols before they consider to spray mancozeb or maneb. Residue analysis done from fruit treated with one, two or four mancozeb in different spray programmes, showed that four successive mancozeb treatments sprayed at monthly intervals during the susceptible period from October to January, resulted in a MRL of 0.45 ppm before the packhouse treatment and 0.26 ppm after the packhouse treatment. Where a single mancozeb treatment was used in a tank mixture with a strobilurin and spray oil (sprayed in January) and preceded with a strobilurin, copper and spray oil (sprayed in November), no mancozeb residues were detected after the fruit was also subjected to packhouse treatments and procedures. Field trials consisting of tank mixtures of mancozeb or copper (tank mixtures of half the registered rate (100 g/hl water)) with the sanitising agent, Sporekill (100 ml/hl water) was not only effective in controlling the disease, but that the mancozeb residue analysis showed that no residues were detected

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from fruit taken from the orchard as well as fruit subjected to normal packhouse procedures. Sporekill in tank mixtures with coppers were also effective in controlling CBS and can also be recommended.

ALTERNARIA BROWN SPOT

Spray programmes should start with the appearing of the first spring flush and growers must also adhere to the spray intervals set for the control of the disease in the summer rainfall regions. Strobilurins, sprayed according to the black spot registration in mid-November and mid-December with mancozeb/copper or copper/mancozeb, will also control the disease. Growers in these areas must then carry on with mancozeb at 24 day intervals until harvest. Remember that dew plays an even greater role than rain in the infection process. New spray programmes with strobilurins will only be developed this coming season for the winter rainfall region, but the commencement dates of the spray programme are also with the first spring flush.

ALTERNARIA BLACK CORE ROT (ABCR)

ABCR is associated with dry, hot (RH < 20%; temperature > 30°C) weather conditions during blossom, accompanied with dew during the evening. The dry weather conditions results in the drying out of the primary style (exterior) while the secondary style (interior) is not affected. This results in cracks in the dry style through which ABCR can infect and stays latent within the fruit until harvest. Certain regions that experienced extremely dry conditions during blossom last year, had serious ABCR infections at harvest and in extreme cases, fruit drop also occurred. Growers can rely on triazole fungicides as registered for control.

BEMESTING EN BESPROEING

H. COETZEE

THE CRUX OF FOLIAR FEEDING

Citrus trees can be fed by means of foliar sprays. The crux of successful foliar sprays revolves around the contact time and concentration of the element in the spray solution.

1. Contact time

The initial contact time is responsible for 80% of the potential absorption of the nutrient. Subsequent re-wetting will improve the overall mass of nutrients utilised, but the initial contact period is more important.

What determines the contact time? One controllable factor namely droplet size, and climate, mainly humidity and temperature, are the factors that control the ultimate contact time.

Suitable droplets have a diameter of 500 to 1000 micron (1 to 0,5 mm) and can be created by using a large orifice of about 3,2 mm, a whirler plate no 56 and a working pressure of 6 to 8 bar.

Humiditeit is die hoogste gedurende die vroeë oggend, dan tweede beste die vroeë aand. Daarom is bespuitings gedurende

koel weer of gedurende die nag meer effektief. Dit is veral belangrik om die toestande so na aan optimaal te hou as moontlik, wanneer kalium en magnesium gespuit word. Poog om die blare vir ten minste 15 minute nat te hou.

Bymiddels wat die kontaktyd kan verleng kan bygevoeg word. Sulke middels sal tipies die druppels teen uitdroging beskerm, die druppels platter maak of afloop beperk. Benatters wat veroorsaak dat 'n film op die blare gevorm word, is nie bevorderlik vir opname nie.

2. Konsentrasie

By blaarvoeding moet 'n sekere minimum massa van die voedingselement opgeneem word om die konsentrasie in die blare te verhoog. Daarom moet 'n sekere massa van die element op die blare gespuit word.

The concentration of the nutrient element in the spray solution can be benchmarked against formulations known to be successful. If you want to try a new formulation, put it to the concentration test. If it fails this test, the chances that it will be able to increase the concentration of the nutrient in the leaves is about zero.

The list below contains some of the benchmark formulation and the concentration in the final solution to be sprayed onto the trees.

Formulation	Dilution rate	Final concentration
Solubor ²	150-200g per 100 litres	300-400mg B per litre water
Zinc nitrate (5,5% Zn)	150-200ml per 100 litres	82,5-110mg Zn per liter water
Manganese sulphate-5H ₂ O (22,8% Mn)	200g per 100 litres	456mg Mn per liter water
Copper sulphate-5H ₂ O (25,4% Cu)	6-10g per 100 litres	15-25mg Cu per litre.

The final concentrations are for water-soluble ions. Some formulations are presented as suspensions and might contain the active ingredient in an insoluble form.

MAXIMUM RESIDUE LEVELS (MRLs)

V. HATTINGH

Growers are reminded that many sprays applied as early as the period petal fall to four weeks after petal fall may result in detectable residues at harvest. It is therefore recommended that the most current version of the document "Restrictions on the use of plant protection products on export citrus" as periodically updated and distributed by CRI, be consulted prior to the application of any sprays to citrus being produced for export.