



Managing root and postharvest diseases following pre-harvest rain

Jan van Niekerk, MC Pretorius, Wilma du Plooy and Natasha Jackson
Citrus Research International (CRI)

Heavy winter rains have been recorded in especially the Western Cape production area that is in the midst of their harvest. These rains led to localised flooding in many areas. Orchards were or are still flooded and orchard soils are still waterlogged. These wet conditions will increase the risk of postharvest diseases and Phytophthora brown rot, occurring on fruit, while also increasing the risk of root rot. These wet weather conditions necessitate immediate action and control measures should be taken. This Cutting Edge serves as an outline of certain actions that should be taken.

Management in the orchard

1. Drainage

It is important to drain orchards as quickly as possible. Prolonged flooded or water-logged conditions will increase root rot, lead to tree stress and also increased risk of fruit becoming damaged or developing decay.

2. Sanitation

All visibly decaying fruit should immediately be removed from the orchard, **PRIOR TO HARVEST**. This fruit not only harbour inoculum for Phytophthora brown rot infections, but also for other postharvest pathogens. Removed fruit should not go to the packhouse or come near any export fruit.

3. Skirt trees

- a. Low-hanging fruit, that are below the orchard flood line, fruit touching the ground or those covered in mud and/or damaged by wind or floating debris, are at high risk of developing Phytophthora brown rot and postharvest decay due to contact with the soil and flood water, where the pathogen inoculum occurs.
- b. If trees are skirted low (below the flood level) or not skirted at all, do not export the skirt fruit that were covered by water as they are at a **HIGH RISK** of decay development during transit.
- c. It is therefore better to remove low-hanging fruit and **TO NOT** put them into bins with fruit destined for export. This must be discarded along with sanitation fruit.

Orchard chemical management options

Phytophthora brown rot and root rot

1. The **contact fungicides** copper (200 g/ 100 L) and mancozeb (200 g/ 100L) are registered as preventative measures against Phytophthora brown rot. *Familiarise yourself with market restrictions, pre-harvest intervals (PHI's), and maximum residue levels (MRL's) of the product used.*
2. With the current situation, **systemic products, like phosphonates, rather than contact fungicides, should be considered.** Several phosphonate products are registered for the control of brown rot and root rot. The registered **foliar applications** will be effective against brown rot and root rot. **At all times, adhere to the label instructions and pre-harvest intervals (PHI).**
3. **Soil drenches and stem applications with phosphonates DO NOT control Phytophthora brown rot.**
4. Foliar applications should commence as soon as conditions allow spray machines to move through the orchards – in very wet orchards some trees might still be under stress.
5. It is suggested that applications should commence in drier orchards or orchards less affected by the flood water first, whilst the rest of the orchards are drying out.
6. **Flooded orchards should get at least two applications to effectively control root rot – one application will not be sufficient.**
7. Care must be taken when spraying soft citrus with phosphonates after colour break as phytotoxicity damage can occur (refer to Cutting Edge 218).

Other postharvest pathogens

Phomopsis, *Galactomyces* and *Penicillium* are major postharvest threats due to the wet conditions. *Botrytis*, *Lasioidiplodia* and *Colletotrichum* may also become more prevalent. There are no registered fungicides that can be used preharvest, or in the near-harvest period to effectively control these pathogens. Specific PAA products are registered as a preharvest sanitizing foliar spray **BUT WILL NOT CONTROL PHYTOPHTHORA BROWN ROT**. This would assist in reducing pathogen inoculum load.

Postharvest management



Postharvest management of Brown rot and other postharvest pathogens should be seen as supporting the orchard management actions taken.

1. Recommendations for degreening

- a. Drench with the recommended mixture as soon as possible, but at least within 6 hours.
- b. Fruit must not spend too long in degreening (preferably not longer than 48 hrs; maximum 72 hrs).
- c. Extended time in degreening predisposes fruit to poor quality and waste.

2. Packhouse precautions

- a. Packhouse hygiene and sanitation are of utmost importance.
- b. Sanitise surfaces regularly and remove and bury rotten fruit at least 100 m from the packhouse.
- c. Tipping of decayed fruit will contaminate the system, reduce the activity of the sanitising agents and lead to progressively more fruit infections along the packline.
- d. Recirculating systems – especially the drench and tip water – must be sanitised/changed regularly as Brown rot and other postharvest pathogen spores from the orchard will accumulate in the water with prolonged use. Peracetic acids (PAAs) are compatible with our aqueous fungicides, but check the concentration often – concentration dissipates over time and can burn the fruit if too high. Calcium hypochlorite (chlorine) can be used in systems where fungicides are not added, such as the wash or high-pressure spray.
- e. Pre-sorting and removal of decayed fruit outside the packhouse's treatment, sorting and packing areas are highly recommended to prevent contamination of the whole system.
- f. Ensure that packhouse chemicals are applied at recommended concentrations, and packhouse procedures and critical control points are managed diligently.
- g. Pack very strictly with regard to injuries, creasing, over-mature fruit, etc. All damaged fruit, and especially **under these severe conditions** are a **HIGH RISK** for export.
- h. Harvest bins should be washed, sanitised and rinsed well before being sent back into the orchard. It is especially important

to remove any soil that adheres to the bins as this can also harbour soilborne pathogens such as *Phytophthora* spp. that cause Brown rot.

- i. Registered postharvest fungicides are available for sour rot control, but take serious note of market restrictions (see Cutting Edge No. 314).
- j. **There is no registered postharvest control for *Phytophthora* brown rot.**

NB: DO NOT TIP ROTTEN FRUIT (ESPECIALLY GREEN AND BLUE MOULD AND SOUR ROT), FOUND IN BINS AFTER DEGREEING, INTO THE PACKHOUSE. PRE-SORT. REMOVE THESE INFECTED FRUIT BEFORE THE FRUIT MOVES INTO THE PACKHOUSE. UNDER NO CIRCUMSTANCES ALLOW ANY FRUIT THAT HAS DROPPED FROM THE TREES ONTO THE PACKLINE.



Bestuur van wortel- en na-oessiektes ná voor-oes reën

Jan van Niekerk, MC Pretorius, Wilma du Plooy
en Natasha Jackson
Citrus Research International (CRI)

Hewige winterreëns is veral in die Wes-Kaap produksie-area aangeteken, wat in die middel van hul oesperiode is. Hierdie reën het tot oorstromings in baie areas gelei. Boorde was, of is steeds, onder water, en in sommige boorde is die gronde nog versuip. Hierdie nat toestande sal die kans van Phytophthora-bruinrot wat op vrugte voorkom, en wortelvrot, verhoog. Dié nat weerstoestande benodig dus drastiese optrede, en dringende beheermaatreëls moet getref word. Hierdie Snykant dien as 'n uiteensetting van aksies wat geneem moet word.

Bestuur in die boord

1. Dreinerings

Dit is belangrik om boorde so vinnig moontlik te dreineer. Langdurige oorstromende of versuipde toestande lei tot boomstres en ook verhoogde risiko dat vrugte beskadig word of bederf ontwikkel.

2. Sanitasie

Alle sigbaar verrotte vrugte moet dadelik uit die boord verwyder word, en veral **VOOROES**. Hierdie vrugte bevat nie net inokulum vir Phytophthora-bruinrot-infeksies nie, maar ook van ander na-oes patogene. Verwyderde vrugte moet nie na die pakhuis toe gaan of naby uitvoervrugte kom nie.

3. Soomsnoei van bome

- Laaghangende vrugte wat onder die boord vloedlyn hang, vrugte wat die grond raak of dié wat met modder bedek is en/of deur wind of drywende reste gewond is, loop 'n hoë risiko om Phytophthora-bruinrot en na-oesbederf te ontwikkel as gevolg van kontak met die grond en vloedwater waar patogeen-inokulum voorkom.
- As bome laag of glad nie gesoomsnoei is nie, moenie die laagliggende vrugte wat met water bedek was, uitvoer nie (tot 1.0 m bokant die boordvloer) aangesien dit 'n **HOË RISIKO** loop om tydens uitvoer bederf te ontwikkel.
- Dit is dus beter om laaghangende vrugte te verwyder en **NIE** in houers met vrugte wat vir uitvoer bestem is, te sit nie. Hierdie vrugte moet saam met sanitasievrugte weggegooi word.

Boord chemiese bestuurs-opsies

Phytophthora-bruinrot en wortelvrot

1. Die **kontakswamdoders** koper (200 g/ 100 L) en mankoseb (200 g/ 100L) is as 'n voorkomende maatreël teen Phytophthora-bruinrot geregistreer. *Wees vertrouwd met markbeperkings, voor-oes intervalle (PHI's) en maksimum residu limiete (MRL'e) van die produk wat gebruik word.*

2. Met die huidige situasie moet **sistemiese produkte**, soos die fosfonate, **eerder as 'n kontakswamdoder, oorweeg word**. Verskeie fosfonaatprodukte is vir die beheer van bruinrot en wortelvrot geregistreer. Die geregistreerde **blaartoedienings** sal effektief teen bruinrot en wortelvrot wees. **Volg te alle tye die etiket-instruksies en voor-oes-intervalle (PHI).**

3. **Grondrenkings en stamtoedienings met fosfonate BEHEER NIE Phytophthora-bruinrot nie.**

4. Blaartoedienings moet begin sodra toestande spuitmasjiene toelaat om deur die boorde te beweeg – in baie nat boorde kan sommige bome nog onder stres verkeer.

5. Daar word voorgestel dat toedienings eers in droër boorde of boorde wat minder deur die vloedwater geraak is, moet begin terwyl die res van die boorde afdroog.

6. **Versuipde boorde moet ten minste twee toedienings kry om wortelvrot effektief te beheer – een toediening sal nie voldoende wees nie.**

7. Wees versigtig om sagte sitrus met fosfonate ná kleurbreek te spuit aangesien fitotoksiese skade kan voor kom (Snykant 218).

Ander na-oes patogene

Phomopsis, Galactomyces en Penicillium is groot bedreigings weens die nat toestande. *Botrytis, Lasiodiplodia* en *Colletotrichum* kan ook meer voorkom. Daar is geen geregistreerde swamdoders wat voor-oes, of in die naby-oesperiode gebruik kan word om hierdie patogene effektief te beheer nie. Spesifieke PAA-produkte is geregistreer as 'n voor-oes-saniteer blaarbespuiting **MAAR SAL NIE PHYTOPHTHORA-BRUINVROT BEHEER NIE**. Dit sal help om patogeen-inokulumlading te verminder.

Na-oes bestuur

Na-oes bestuur van bruinrot en ander na-oes patogene moet gesien word as 'n ondersteuning van die boordbestuurs-aksies wat geneem is.

1. Aanbevelings vir ontgroening

JOU HEFFING WERK VIR JOU – PRODUSENTE SE HEFFINGS WORD AANGEWEND OM DIE AKTIWITEITE VAN DIE CRI TE BEFONDS



- a. Stort (drench) met die aanbevole mengsel so gou as moontlik, maar ten minste binne 6 ure na oes.
- b. Vrugte moet nie te lank in ontgroening bly nie (verkieslik nie langer as 48 ure nie; maksimum 72 ure).
- c. Verlengde tyd in ontgroening lei tot vrugte van swak kwaliteit en vermorsing.

2. Pakhuis voorsorgmaatreëls

- a. Pakhuishigiëne en sanitasie is van uiterste belang.
- b. Ontsmet oppervlakte gereeld en verwyder en begrawe vrot vrugte minstens 100 m van die pakhuis af.
- c. Inneem van verrotte vrugte sal die stelsel besoedel, die aktiwiteit van die ontsmettingsmiddels verminder en tot toenemend meer vrug-infeksies langs die paklyn lei.
- d. Hersirkulasiestelsels – veral die stort- en dompelbad water – moet gereeld ontsmet/verander word aangesien bruinvrot en ander na-oes patogeenspore uit die boord in die water sal ophoop met langdurige gebruik. Perasynsure (PAA's) is verenigbaar met ons waterige swamdoders, maar kyk gereeld na die konsentrasie – dit verdamp mettertyd en kan die vrugte brand as dit te hoog is. Kalsiumhipochloriet (chloor) kan gebruik word in stelsels waar swamdoders nie bygevoeg word nie, soos die was- of hoëdrukspuite.
- e. Vooraf-sortering en verwydering van verrotte vrugte buite die pakhuis se behandelings-, sorteer- en verpakkingsareas, word sterk aanbeveel om kontaminasie van die hele stelsel te voorkom.
- f. Verseker dat pakhuischemikalieë teen aanbevole konsentrasies toegedien word, en pakhuisprosedures en kritieke beheerpunte noukeurig bestuur word.
- g. Pak baie streng met betrekking tot beserings, kraakskil, óór-ryp vrugte, ens. Alle beskadigde vrugte, **veral onder hierdie uiterste toestande**, is 'n HOË RISIKO vir uitvoer.
- h. Oeshouers moet gewas, ontsmet en goed afgespoel word voordat dit teruggestuur word na die boord. Dit is veral belangrik om enige grond wat aan die houers kleef, te verwyder aangesien dit ook grondgedraagde patogene soos *Phytophthora* spp. kan huisves wat bruinvrot veroorsaak.
- i. Geregistreerde na-oes swamdoders is beskikbaar vir suurvrotbeheer, maar neem ernstig kennis van markbeperkings (sien Snykant No. 314).

- j. Daar is geen geregistreerde na-oes beheer vir *Phytophthora*-bruinvrot nie.

NB: MOENIE VROT VRUGTE (VERAL GROEN-EN BLOUSKIMMEL EN SUURVROT), WAT IN HOUERS NÁ ONTGROENING GEVIND WORD, IN DIE PAKHUIS INNEEM NIE. VOOR-SORTEER. VERWYDER HIERDIE GEÏNFEKTEERDE VRUGTE VOORDAT DIE VRUGTE IN DIE PAKHUIS INBEWEEG. LAAT ONDER GEEN OMSTANDIGHEDE ENIGE VRUGTE WAT VANAF DIE BOME GEVAL HET, OP DIE PAKLYN TOE NIE.