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Orchard and packhouse procedures for sour rot control

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Recent rainfall across several citrus production regions has increased the risk of sour rot caused by *Geotrichum citri-aurantii*. High-risk areas currently include Letsitele, Northern Limpopo, Hoedspruit, KZN, and Nelspruit, with Kirkwood and Patensie also presenting elevated risk. *Geotrichum citri-aurantii* is primarily a wound-invading pathogen commonly associated with orchard soils and contaminated packhouse environments. Under wet conditions, inoculum can be splash-dispersed onto fruit surfaces, increasing the likelihood of infection if fruit are wounded during harvesting and handling. Fruit harvested during or shortly after rainfall, or when orchard soils are saturated, are particularly susceptible. Where sour rot has been observed in the orchard before harvest, additional care should be taken to limit postharvest infections and packhouse contamination.

The guidelines outlined in this article are built on previous Cutting Edges No 199, 204 and 317, with additional considerations included.

Orchard management considerations

- Remove and destroy fallen, rotten and injured fruit regularly to reduce inoculum.
- Employ sanitation teams ahead of harvest to remove infected fruit.
- Remove split fruit and fruit with navel-end cracks as soon as possible as part of the orchard sanitation protocol.
- Avoid harvesting low-hanging fruit for export, and rather skirt trees.
- Do not mix fruit that has been in contact with soil with export-quality fruit.
- Manage insect damage caused by fruit fly and FCM, which increases infection risk.
- Certain peracetic acid (PAA) + hydrogen peroxide-based sanitisers are registered for foliar applications on citrus close to harvest, and may reduce sour rot pressure, particularly following high insect damage or light hail events.
- Foliar applications of PAA + hydrogen peroxide must be done using registered products, strictly according to label instructions

Harvesting considerations

- Avoid harvesting within a week after rainfall, if possible, or even longer where soils are saturated.
- Where possible, harvesting should be delayed until fruit surfaces are dry.
- Train harvest teams to conduct regular compliance checks using indigo carmine staining to ensure that wounding during harvest is limited, as sour rot primarily requires wounds that penetrate the albedo tissue for infection to occur.
- Harvest bins and picking bags should be kept as clean as possible during harvesting.

Limit packhouse contamination risk

- Remove decayed or damaged fruit that were accidentally picked during harvesting, or that emerged during storage or degreening, on a pre-sorting line, to reduce contamination of the packhouse and packing line.
- Clean surfaces by removing fruit waste and debris from surfaces and sanitise continuously.
- Ensure that production, farm and orchard managers notify the packhouse of problem orchards before fruit arrival, to allow:
  1. Additional grading capacity
  2. Diversion to processing or local markets where necessary
- Remove all graded-out rotten fruit from the packhouse as soon as possible, including juice/factory bin fruit.
- Sanitise all recirculating systems, especially drench and tip water. Sanitisers must function optimally to limit the accumulation of spores of *Geotrichum citri-aurantii* and other postharvest citrus pathogens in these mixtures.
  1. PAA products are compatible with fungicides, but concentrations must be monitored regularly.
  2. Calcium hypochlorite (chlorine) can be used in systems without fungicides (e.g. wash or high-pressure spray systems). The pH, active chlorine and oxidation-Reduction Potential (ORP) of the solution should be monitored regularly.
  3. Refer to CRI factsheets for additional sanitiser options suitable for recirculating systems.
- Clean (i.e. wash, rinse and sanitise) harvest bins thoroughly before returning them to the orchard.
- Harvest bins should be cleaned as follows:
  1. Remove organic matter (leaves, soil and fruit debris)
  2. Wash bins using detergent with a high-pressure water sprayer
  3. Rinse thoroughly to remove detergent residues
  4. Sanitise using a suitable food-grade sanitiser (Refer to CRI factsheets for options)
  5. Allow bins to dry before reuse

Optimise postharvest handling and treatments

- Treat fruit as soon as possible after harvest (preferably within 24 hours).
- Degreening increases the risk of sour rot, therefore avoid degreening or keep the duration as short as possible.
- Chemical control for sour rot in pre-packhouse drench systems should be considered.
    1. **Guazatine** remains the most effective option **(only for markets that permit use)**.
    2. **Imazalil 300 EC** has some sour rot control.
    3. Based on recent research at CRI, **potassium sorbate**-containing products applied in combination with **OPP** has shown potential to suppress sour rot, particularly in pre-packhouse drench mixtures with thiabendazole (TBZ).
    4. Similarly, research showed that **clove oil-based formulations** applied in pre-packhouse drenches with TBZ in combination with azoxystrobin or pyrimethanil have potential to suppress sour rot. Always consult the product label when using clove oil-based formulations, as warnings regarding phytotoxicity and application conditions may apply.
- Only use registered products, strictly according to label instructions.
- Start packing high-risk fruit as soon as possible after the pre-packhouse drench.
- Initiate the cold chain as soon as possible after packing.

Sour rot control forms part of an integrated system requiring clean orchards, careful harvesting, hygienic packing lines, rapid processing with appropriate fungicide use, and early cold storage

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Prosedures in boorde en pakhuise vir suurvrotbeheer

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Onlangse reënval in verskeie sitrusproduksiestreke het die risiko van suurvrot wat deur *Geotrichum citri-aurantii* veroorsaak word, verhoog. Hoë-risikogebiede sluit tans Letsitele, Noord-Limpopo, Hoedspruit, KZN en Nelspruit in, met Kirkwood en Patensie wat ook 'n verhoogde risiko inhou. *Geotrichum citri-aurantii* is hoofsaaklik 'n wond-indringende patogeen wat algemeen met boordgronde en besmette pakhuisomgewings geassosieer word. Onder nat toestande kan inokulum op vrugoppervlaktes versprei word, en die waarskynlikheid van infeksie verhoog wanneer vrugte tydens oes en hantering gewond is. Vrugte wat tydens of kort na reënval geoes word, of wanneer boordgronde versadig is, is veral vatbaar. Waar suurvrot reeds vóór oes in die boord waargeneem is, moet ekstra sorg gedra word om na-oesinfeksies en pakhuiskontaminasie te beperk.

Die riglyne wat in hierdie artikel uiteengesit word, is gebaseer op vorige Snykante No. 199, 204 en 317, met bykomende oorwegings ingesluit.

Oorwegings vir boordbestuur

- Verwyder en vernietig afgevalde, vrot en beseerde vrugte gereeld om inokulum te verminder.
- Gebruik sanitasiespanne vóór oes om hierdie vrugte te verwyder.
- Verwyder gekraakte vrugte en vrugte met nawel-ent krake so gou as moontlik as deel van die boordsanitasieprotokol.
- Vermy die oes van laaghangende vrugte vir uitvoer, en soomsnoei bome eerder.
- Moenie vrugte wat in kontak met grond was met uitvoergehalte vrugte meng nie.
- Bestuur insekskade veroorsaak deur vrugtevlieë en VKM, wat infeksierisiko verhoog.
- Sekere perasynsuur (PAA) + waterstofperoksied-gebaseerde ontsmettingsmiddels is geregistreer vir blaartoediening op sitrus naby oes, en kan suurvrotdruk verminder, veral ná hoë insekskade of ligte haelgebeurtenisse.
- Blaartoediening van PAA + waterstofperoksied moet met geregistreerde produkte gedoen word, streng volgens etiket-instruksies.

Oesoorwegings

- Vermy oes binne 'n week ná reënval waar moontlik, of selfs langer waar grond versadig is.
- Waar moontlik, moet oes uitgestel word totdat vrug oppervlaktes droog is.
- Lei oesspanne op om gereelde nakomingskontroles met behulp van indigokarmynkleuring te doen om te verseker dat wonde tydens oes beperk word, aangesien *Geotrichum citri-aurantii* hoofsaaklik wonde benodig wat die albedo-weefsel binnedring vir infeksie om plaas te vind.
- Oeshouers en pluksakke moet so skoon as moontlik gehou word tydens oes.

Beperk pakhuiskontaminasie-risiko

- Verwyder vrot of beskadigde vrugte wat per ongeluk tydens oes gepluk is, of wat tydens opberging of ontgroening na vore gekom het, deur 'n vóórsorteringslyn om kontaminasie van die pakhuis en paklyn te verminder.
- Maak oppervlaktes voortdurend skoon deur vrug-afval vanaf oppervlaktes te verwyder en ontsmet voortdurend.
- Verseker dat produksie-, plaas- en boordbestuurders die pakhuis van probleemboorde in kennis stel vóór vrugte se aankoms, om die volgende toe te laat:
  1. Bykomende graderingskapasiteit
  2. Herleiding na verwerking of plaaslike markte waar nodig
- Verwyder alle uitgegradeerde vrot vrugte so gou as moontlik uit die pakhuis, insluitend sap-/fabriekshouervrugte
- Sanitiseer alle hersirkulerende stelsels, veral drenk- en stortwater. Saniteerders moet optimaal funksioneer om die ophoping van suurvrot, insluitend spore van alle ander na-oes sitruspatogene in hierdie mengsels, te beperk.
  1. PAA produkte is versoenbaar met swamdoders, maar konsentrasies moet gereeld gemonitor word.
  2. Kalsiumhipochloriet (chloor) kan in stelsels sonder swamdoders gebruik word (bv. was- of hoëdrukspuitstelsels). Die pH, aktiewe chloor en oksidasie-reduksiepotensiaal (ORP) van die oplossing moet gereeld gemonitor word.
  3. Verwys na CRI-feiteblaaie vir bykomende ontsmettingsopsies wat geskik is vir hersirkuleringstelsels.
- Maak oeshouers deeglik skoon (d.w.s. was, spoel en ontsmet) voordat dit na die boord terug geneem word.
- Oeshouers moet soos volg skoongemaak word:
  1. Verwyder organiese materiaal (blare, grond en vrugreste).
  2. Was houers met skoonmaakmiddel en 'n hoëdruk-waterspuit.

3. Spoel deeglik af om skoonmaakmiddelreste te verwyder.
4. Ontsmet met 'n geskikte voedselgraad-ontsmettingsmiddel (verwys na CRI-feiteblaaie vir opsies).
5. Laat die houers droog word voordat dit hergebruik word.

Optimaliseer na-oeshantering en -behandelings

- Behandel vrugte so gou as moontlik ná oes (verkieslik binne 24 uur).
- Ontgroening verhoog die risiko van suurvrot, vermy dus ontgroening of hou die duur so kort as moontlik.
- Chemiese beheer vir suurvrot in voorpakhuis-drenkstelsels moet oorweeg word.
  1. **Guazatien** bly die mees effektiewe opsie **(slegs vir markte wat gebruik toelaat)**.
  2. **Imazalil 300 EC** het 'n mate van suurvot beheer.
  3. Gebaseer op onlangse navorsing by CRI, het **kaliumsorbaatbevattende** produkte wat in kombinasie met **OPP** toegedien word, die potensiaal getoon om suurvrot te onderdruk, veral in voorpakhuis-drenkmengsels met thiabendazole (TBZ).
  4. Net so het navorsing getoon dat **naeltjie-olie-gebaseerde formulasies** wat in voorpakhuis-drenking met TBZ in kombinasie met azoxystrobin of pyrimethanil toegedien word, potensiaal teen suurvrot het. Raadpleeg altyd die produk-etiket wanneer naeltjie-olie-gebaseerde formulasies gebruik word, aangesien waarskuwings rakende fitotoksisiteit en toedieningsvoorwaardes van toepassing kan wees.
- Gebruik slegs geregistreerde produkte, streng volgens etiket-instruksies.
- Begin so gou as moontlik ná die voorpakhuis-drenking met die verpakking van hoërisiko-vrugte.
- Begin die koueketting so gou as moontlik ná verpakking.

Suurvrotbeheer vorm deel van 'n geïntegreerde stelsel wat skoon boorde, versigtige oes, higiëniese paklyne, vinnige verwerking met gepaste swamdodergebruik, en vroeë koue-opberging, vereis.

Vir meer inligting, kontak asseblief:

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Verwysings

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