



Cutting Edge / Snykant

RESEARCH NEWS FROM CITRUS RESEARCH INTERNATIONAL
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Ryp en vriesskade van sitrus vrugte

'n Gids om die voorkoms van vries skade aan vrugte te bepaal

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Opsomming

- Temperatuur onder -3°C kan lei tot vries skade van vrugte.
- Die omvang van die skade moet bepaal word voor vrugte ge-oes word.
- Pluk monsters van 50 vrugte uit elke boorde, sluit alle mikroklimaat en kultivars in.
- Sit in koelkamer of yskas (nie vrieskas).
- Haal elke 2-3 dae vrugte uit en evalueer deur vrugte oop te sny.
- Kyk vir uitdroging van pulp asook wit hesperidin kristalle tussen segment.
- Sny vrugte van stingel kant in 1 cm dik wiele om skade te bepaal.
- Indien vries simptome voorkom kan vrugte nie uitgevoer word nie.
- Vrugte bo en aan buitekant van die boom is gewoonlik die ergste geraak.

Inleiding

Temperatuur onder 0°C kan aanleiding gee tot ernstige skade aan sitrus vrugte en bome. Meeste sitrus kan egter temperatuur onder -2.2°C hanteer as die blootstelling periode kort was. As die periode by die temperatuur egter oor 'n paar ure strek kan daar ernstige gevolge wees.

Sien tabelle vir sensitiwiteit van spesifieke kultivars by vries temperature.

Koue skade aan sitrus vrugte

Voor-oes vries en koueskode word veroorsaak deur of radiasie of adveksie ryp. Toestande wat radiasie ryp bevoordeel is kalm wolklose nagte waar hitte vinnig verloor word deur radiasie vanaf die aarde. Adventiewe ryp word veroorsaak deur 'n wind wat 'n koue lugmassa aanblaas en beskadig gewoonlik meer boorde as die radiasieryp a.g.v. die skielike en vinnige hitte verlies van die plantweefsel.

Skade aan die vrugte begin binne 'n paar uur na die temperature onder vriespunt daal a.g.v. die water in die sapsakkies wat vries en dan die sakkies stukkend steek. Dit sal mettertyd

lei tot waterverlies en uitdroging van die vrug. Die skil van 'n beskadigde vrug kan intak bly vir 'n bepaalde periode maar gaan 'n verhoogde verouderings tempo het en sal tot meer bederf lei. Die agteruitgang van 'n beskadigde vrug kan so vinnig as 'n paar dae wees in ernstige gevalle maar die simptome word meestal na 2-3 weke gesien. Erge vriesskade sal ook lei tot 'n verhoogde voorkoms van vrugval.

Dit is belangrik om die vriesskade aan die boom se lote en blare ook te beoordeel as die omvang van die vriesskade aan die vrugte bepaal word: as net jong blare beskadig is sal minder vrugte beskadig wees. As ouer blare egter beskadig is sal die hele boom se vrugte gewoonlik beskadig wees.

Vriesskade simptome van vrugte

Dit is baie moeilik om lae vlakke van vriesskade te bepaal net van die pulp en skil se voorkoms. Maar as daar verhoogde vriesskade was vererger die skade en word dit makliker om te bepaal. Na die sapsakkies deur die yskristalle stukkend gestee word lek die vog uit en die segmente sal na 'n paar weke uitgedroog wees. Die segmente sal krimp en verwing wees. Die uitdroging sal ook lei tot laer sap inhoud asook suiker en suurvlakke. Onder volgehoue koue toestande kan die pulp verdroog van onvolwasse vrugte sonder dat die skil enigsins beskading toon. As 'n sekondêre simptome van koueskode van lemoene kan gekyk word na die voorkoms van wit hesperidin kristalle wat vorm op die membrane tussen die segment en op die sapsakkies. As die kristalle oor 1m is en baie voorkom, is die vrugte erg beskadig en sal uitdroog. Hesperidin is 'n normale komponent van lemoensap en benadeel nie die vrugtoestand nie.

Gids om die mate van vriesskade te bepaal

Groot verliese sal deur alle betrokkenes gelei word as vrugte met vriesskade uitgevoer word. Vrugte wat in 'n sterilisasie protokol geplaas word sal lei tot nog 'n hoër vlak van simptome en bederf.

As boorde aan 'n paar opeenvolgende nagte onder -3°C blootgestel was is daar 'n baie groot kans op vries skade van die vrugte. Boorde onder drupbesproeiing en met 'n gras bedekking tussen die rye word gewoonlik die



Cutting Edge / Snykant

RESEARCH NEWS FROM CITRUS RESEARCH INTERNATIONAL
NAVORSINGSNUUS VAN CITRUS RESEARCH INTERNATIONAL

June / Junie 2007

No / Nr 57

ergste geraak maar as 'n kouefront area getref het sal alle boorde potensiële koueskade aan die vrugte toon.

- Die word aanbeveel dat pluk van vrugte gestop moet word na so 'n klimaattoestand.
- Pluk 'n monster van 20-50 vrugte van elke boord en sluit alle kultivars asook mikroklimate areas op die plaas in.
- Plaas vrugte in 'n koelkamer of yskas (nie vrieskas) en sny elke 2-3 dae 'n paar vrugte op om te kyk of daar simptome van uitdroging of wit kristalle in die vrug is.
- 'n Manier om die mate van skade te bepaal is om die vrugte in 1cm dik wiele van die steel-end te sny (koueskade is gewoonlik die meeste aan die kant die vrug).
- Deur opeenvolgende snitte te maak van dieselfde vrug kan gesien word hoe erg die skade is en dit kan help om saam met jou konsultant, pakhuis of uitvoerder te besluit of die vrugte geskik is vir uitvoer, plaaslike bemarking of vir prosessering (vir meer informasie sien Miller, 2006).
- Dit is belangrik dat daar na verskille tussen binne en buitevrugte asook na die top en vrugte naby die grond gekyk word (binne en laer hangende vrugte is gewoonlik minder beskadig).
- As min wit kristalle in die buitevrugte gevind word kan die binnevrugte min skade het maar as baie wit kristalle en uitdroging voorkom van die buitevrugte sal die binnevrugte ook beskadig wees.
- As daar tekens na 2 weke is van uitdroging of wit kristalle is die vrugte nie geskik vir uitvoer nie. Her-evalueer na 4 weke; die meeste skade sal nou maklik wees om te herken.

- Maatreëls sal volg in 'n opvolg Snykant oor hoe om die bome te versorg wat koue skade gelei het.

Bedankings

Steve Turner, Ballie Wahl, Stephan Verreyne, Mark Fry and Graham Barry.

Verdere bronne van informasie

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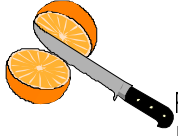
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Cutting Edge / Snykant

RESEARCH NEWS FROM CITRUS RESEARCH INTERNATIONAL
NAVORSINGSNUUS VAN CITRUS RESEARCH INTERNATIONAL

June / Junie 2007

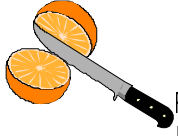
No / Nr 57



Uitdroging van segmente na vrieskade / Drying out of juice vesicles after freeze damage



Uitdroging van segmente na vrieskade (Amat, 1991) / Drying out of juice vesicles due to rupture of juice sacs after freeze (Amat, 1991)



Cutting Edge / Snykant

RESEARCH NEWS FROM CITRUS RESEARCH INTERNATIONAL
NAVORSINGSNUUS VAN CITRUS RESEARCH INTERNATIONAL

June / Junie 2007

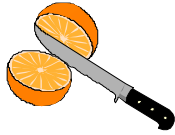
No / Nr 57



Wit hesperidin kristalle vorm op segment membrane van vriesskade (Amat, 1991) /
White hesperidin crystals forming on the membrane segment (Amat, 1991)



Wit hesperidin kristalle vorm op segment membrane van vriesskade (Tucker *et al.*, 1994) /
White hesperidin crystals forming on the membrane segment (Tucker *et al.*, 1994)



Cutting Edge / Snykant

RESEARCH NEWS FROM CITRUS RESEARCH INTERNATIONAL
NAVORSINGSNUUS VAN CITRUS RESEARCH INTERNATIONAL

June / Junie 2007

No / Nr 57

Relative frost sensitivity of selected citrus trees / Relatiewe rypsensitiwiteit van sekere sitrusbome

High sensitivity	Medium sensitivity	Low sensitivity
Citron	Grapefruit	Satsuma mandarins
Lemon	Mandarin orange hybrids	Kumquat
Lime	Orange	

(Geisel and Unruh, 2003)

Critical frost damage temperatures for selected citrus fruit / Kritiese rypskadetemperature vir sekere sitrusvrugte

Fruit	Critical temperature (°C)*
Lemon buds and blossom	-2.8
Lemon, button, <13 mm diameter	-1.4 to -0.8
Lemon, green, >13 mm diameter	-2.8 to -1.4
Lemons, tree-ripe	-3.3 to -0.8
Oranges, green	-1.9 to -1.4
Oranges, grapefruit and mandarins, half-ripe	-2.8 to -1.7
Oranges, grapefruit and mandarins, tree-ripe	-3.9 to -1.7

*Critical temperatures are affected by relative humidity and duration. Fruit can withstand the lower temperature ranges in drier air and shorter durations of cold.

(Geisel and Unruh, 2003)

Frost and freeze damage of citrus fruit

A guideline to determining freeze damage incidence of citrus fruit

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-2.2°C with little or no damage if the duration is not excessive. However, lower temperatures or a longer duration of subzero temperatures will increase the damage, starting from the fruit and in the most severe cases leading to the eventual dieback of branches and killing of the tree.

See tables for relative sensitivity to frost of different cultivars

Executive summary

- Temperatures below -3°C in orchards lead to freeze damage of fruit.
- Extent of damaged fruit must be assessed before picking and packing of fruit.
- Pick a sample of 50 fruit from all orchards, including different microclimates and cultivars.
- Place in cold room or refrigerator.
- Cut these fruit every 2-3 days in 1 cm-thick circles from the stem-end.
- If dried out symptoms or white hesperidin crystals are evident, fruit should not be packed for export.
- Fruit from the outside and top of the tree canopy is normally more affected.

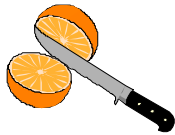
Damage to citrus fruit

Preharvest freezing and cold damage is caused by either radiative frost or advective freeze. Conditions favoring radiation frost are calm and cloudless nights when heat is rapidly lost by radiation from the earth. Advective freeze is caused by wind blowing in a cold air mass and is often more damaging to orchards than radiative frost due to the rapid heat loss from the plant tissue.

Introduction

Subzero temperatures can result in significant damage to citrus trees, leaves and fruit. Most citrus will tolerate temperatures as low as

Damage to fruit starts to happen within a few hours after the frost when the juice vesicles start to rupture as ice crystals form inside them. This will result in water loss and drying out of the fruit pulp over a period. Frost damaged fruit can maintain their rind integrity for a few days after the event, but the rind will have a very high senescence rate and resultant breakdown, which will result in decay



Cutting Edge / Snykant

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NAVORSINGSNUUS VAN CITRUS RESEARCH INTERNATIONAL

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setting in soon. The deterioration of frost-damaged fruit usually occurs within a few days to 2-4 weeks, depending on storage conditions, temperature and other environmental factors. High freeze or frost damage could result in a high fruit abscission rate.

It is important to assess the damage to the tree (leaves and shoots) in order to determine the severity of fruit damage: if only the young flush has been damaged (burned) the incidence of fruit damage should be low. When mature leaves show any damage expect a severe incidence of freeze damaged fruit. If oleo-like damage occurs on the stem-end of fruit the damage is also severe and often the fruit on the whole tree will be affected.

Freeze damage symptoms in fruit

Minor freeze injury will not be obvious externally and difficult to detect internally. But symptoms become more obvious as the injury increases. Juice vesicles are ruptured by the ice crystals that formed in the juice sacs. Later the juice vesicles in injured areas will dry out, shrink and separate. If you slice through an injured fruit, there will be a distortion of the segment membranes. The drying out of the pulp will result in lower juice content, total soluble solids and acidity. Under continued cold conditions the juice sacs will dry out without visible injury to the rind, especially in immature fruit. As a secondary symptom, white hesperidin crystals may be deposited between carpellary membranes and vesicle surfaces of damaged fruit. If these crystals are large (over 1 mm long) and commonly found, a fruit will be damaged and dried out. Hesperidin is a normal component of orange juice and its crystallization does not affect the wholesomeness of the fruit.

Guideline to assess the extent of freeze damage to fruit

Serious losses will be realized by everyone involved in export of frost damaged fruit. Fruit prepared for a market with a sterilization protocol will suffer even more symptoms of frost damage if shipped at this temperature regime.

If orchards were subjected for a few consecutive nights to $\leq -3^{\circ}\text{C}$ there is serious danger of frost damage to fruit. Orchards

under drip irrigation and with grass cover between rows are normally more severely affected, but all orchards will be affected if a cold front with accompanying freeze temperatures reaches a production area.

- It is recommended that picking of fruit should be stopped after such an event.
- Take samples (20-50 fruit per orchard or sampling site) covering all microclimates on the farm as well as the different cultivars. Place the fruit in a cold room or refrigerator (not in a freezer).
- Sample these fruit every 2-3 days by cutting them open to inspect for symptoms like drying out or white crystal formation on segment walls.
- One way to assess damaged fruit is to cut 0.5-1 cm thick "wheels" from the stem-end (freeze damage is normally more severe at this end). By making successive cuts it will be possible to determine the damage and in consultation with your exporter, be able to determine how fruit should be handled. e.g. export, local market or processing (for more information see Miller, 2006).
- It is also important to determine if there is a difference in severity between fruit borne on the inside versus the outside of the canopy.
- If light hesperidium crystals are found on the outside fruit, the inside fruit could have a low incidence of freeze damage but if heavy crystal development occurs on outside fruit with some rind damage, inside fruit would also be damaged.
- If there are symptoms of drying out after 2 weeks, fruit from such an orchard should not be exported. Re-evaluate after 4 weeks. By this stage damage should be easily seen.
- Cultural practices focusing on the damaged tree and what steps need to be taken will be addressed in a follow-up Cutting Edge.

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