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SECURING THE FUTURE OF CITRUS THROUGH SCIENCE
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Recommended management practices for blossom blight in orchards 2026

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Botrytis cinerea has historically been accepted as the primary causal agent of premature flower fall, rind distortion, and post-harvest decay of lemons; however, recent research indicates that other pathogens may also be involved in this Blossom Blight disease complex. Although most reported on lemons, infection of flowers leading to rind distortion has also been observed on other citrus types. Fruit injury on more mature fruit, however, can also result in corky ridges on the fruit surface.
This Cutting Edge serves to inform growers about the pathogen and disease, and to advise on practices to manage Botrytis grey mould (blossom blight) in orchards.

The pathogen and disease

Botrytis grey mould on flowers (Fig. 1) is caused by the fungal pathogen *Botrytis cinerea.* This pathogen is ubiquitous, with a wide host range, and causes a variety of different symptoms on infected plants, both pre- and post-harvest. *Botrytis cinerea* occurs predominantly in cool, wet citrus production areas in South Africa, although the disease has recently been reported from warmer areas and citrus under nets.

The pathogen survives saprophytically as mycelium and/or sclerotia (sexual survival spores). It overwinters in or on plant debris such as old leaves, old flowers, mummified fruit, and dead twigs or wood. Inoculum is dispersed by wind, water and insects.

Infection of flowers occurs during cool and prolonged wet conditions during blossom time. Infected flowers may wilt and die, reducing yield. Diseases caused by *Botrytis cinerea* are often referred to as “grey mould”, due to the velvety grey spores that form on infected tissues. These spores are, however, not always present in the early stages of infection. Post-harvest decay by *Botrytis* occurs mostly through wounds. *Botrytis*-infected areas on fruit may be soft and brown with brown or grey bumps and irregular scars (Fig. 2).

The optimal environmental conditions for infection by *B. cinerea* are temperatures between 15 and 20°C (optimal 18°C), relative humidity > 90% and wetness duration of ≥ 16 hours.

Management recommendations

Management of Botrytis grey mould requires an integrated strategy that incorporates cultural practices, biological, and chemical control measures, with the latter required when cool, wet conditions occur during blossom periods.

Cultural practices. Since high relative humidity, reduced light and moderate temperatures favour disease development, proper pruning is essential. This will increase light penetration and decrease relative humidity in the tree canopy. Given the ubiquitous nature and wide host range of *Botrytis*, inoculum management will have limited benefit. Nitrogen and calcium fertilisation must be optimised to avoid excessive vegetative growth and strengthen cell walls.

Biological control. The use of fungi, bacteria and yeasts to control diseases caused by *Botrytis cinerea* has been studied for over 30 years. Biological control agents can be used as an alternative to synthetic fungicides; they are more environmentally friendly, with a lower risk of resistance development. However, climate conditions should also favour the biological control agents for optimal effectiveness.

Chemical management. Fungicides are effective in managing *Botrytis* diseases, but chemical control cannot be relied upon as the sole management tool. Resistance of *Botrytis cinerea* to various fungicides has been reported globally, and it is thus imperative to use fungicides responsibly. In addition, when crops require protection over an extended period due to extended blossom periods, the risk of resistance increases when the same active ingredient is repeatedly used. Fungicides applied during full flower and fruit set for Alternaria Brown Spot control could also affect *Botrytis* infection of flowers. The currently **registered** control options for Botrytis grey mould in South Africa are listed in Table 1.

CRI-PhytRisk. Botrytis Grey Mould will only be problematic during cool, wet conditions in the blossom period. A Botrytis

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infection model is available on the CRI-PhytRisk website (www.cri-phytrisk.co.za). This model is based on published epidemiological models for *B. cinerea* spore production and infection, and is currently being validated in CRI research projects. Growers can nonetheless use these Botrytis infection predictions in CRI-PhytRisk as a decision support tool, i.e. whether to apply biocontrol or chemical control sprays during blossom or not.

Table 1. Registered biological and chemical control options for Botrytis Grey Mould (based on registered label recommendations)

Active ingredient	**Dosage**	**Application**
Pyrimethanil (anilino-pyrimidine)	120ml/100L water	Apply the first Botrytis flower blight application at blossom. Apply in a preventative fungicide spray programme with fungicides from different FRAC groups, in 14 – 21-day intervals, depending on cultivar and disease pressure. Ensure thorough spray coverage. Apply this product only once in the preventative flower blight spray programme.
Pyrimethanil (anilino-pyrimidine) + fludioxonil (phenylpyrrole)	120ml/100L water	Apply the first preventative Botrytis flower blight application at blossom. Apply in a preventative spray programme with fungicides from different FRAC groups, in 14 – 21-day intervals, depending on cultivar and disease pressure. Ensure thorough spray coverage. Apply only once in the preventative flower blight spray programme. **Do not apply after fruit set.**
Azoxystrobin (strobilurin)	20ml/100L water	Apply the first application at blossom. Two (2) – three (3) applications can be applied at 14 – 21-day intervals, depending on cultivar and disease pressure. Ensure thorough spray coverage. Do not apply curatively. If a fungal disease spray programme includes a FRAC 11 fungicide after blossom, start and end the Botrytis flower blight control programme with applications of registered fungicides from a different FRAC group.
Trichoderma asperellum strain TRC900	200ml/ha	Foliar spray every 10-14 days. Soil drench monthly. Do not mix with quaternary ammonium.
Bacillus amyloliquefaciens subsp. *plantarum* D747	1kg/ha (4000-6000L water)	Apply as a full cover spray, but not run-off. Start application at the first sign of disease, or during periods favourable to disease outbreak. Focus the applications on flowers. Apply at 7-day intervals. Four to six applications are recommended.

Figure 1: Rind distortion symptoms on lemon

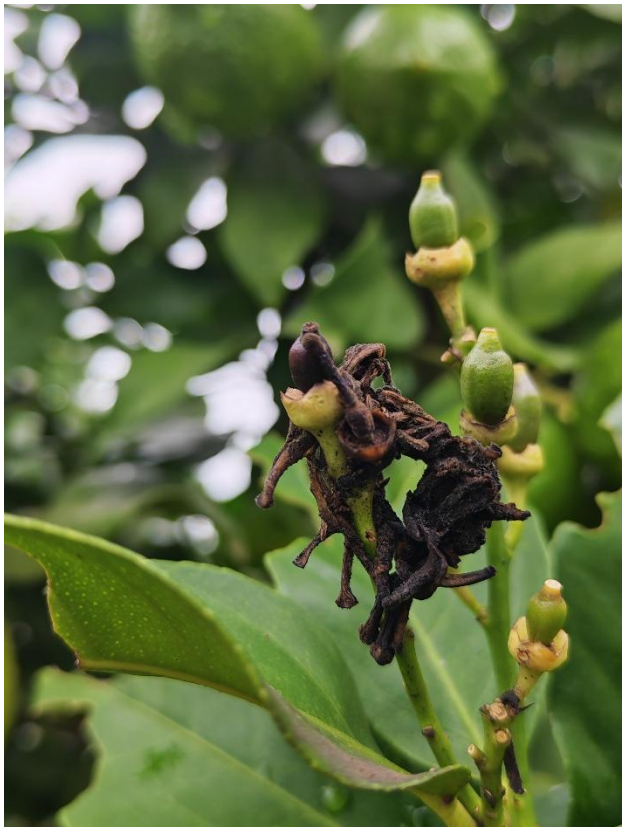

Figure 2: Blossom blight symptoms

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Voorgestelde bestuurspraktyke van Bloeiselversenging in boorde 2026

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Botrytis cinerea word histories beskou as die primêre veroorsakende organisme van vroegtydige blomval, skilvervorming en na-oesverrotting van suurlemoene, maar onlangse navorsing toon dat ander patogene moontlik ook betrokke is by hierdie bloeiselversenging-siektekompleks (Fig. 1). Alhoewel dit meestal op suurlemoene gerapporteer word, is infeksie van blomme wat tot skilvervorming lei, ook op ander sitrustipes waargeneem.

Hierdie Snykant het ten doel om produsente oor die patogeen en siekte in te lig, en om advies oor praktyke wat gevolg moet word om Botrytis-grysskimmel (bloeiselversenging) in boorde te bestuur te gee.

Die patogeen en siekte

Botrytis-grysskimmel op blomme word deur die swampatogeen *Botrytis cinerea* veroorsaak. Hierdie patogeen is alomteenwoordig, met 'n wye gasheerreeks, en veroorsaak 'n verskeidenheid verskillende simptome op geïnfekteerde plante. *Botrytis cinerea* kom hoofsaaklik in koel, nat sitrusproduksiegebiede in Suid-Afrika voor, hoewel die siekte onlangs in warmer gebiede en sitrus onder nette aangemeld is.

Die patogeen oorleef saprofities as miselia en/of sklerotia (geslagtelike oorlewings spore). Dit oorwinter in of op plantreste soos ou blare, ou blomme, gemummifiseerde vrugte en dooie takkies of hout. Inokulum word deur wind, water en insekte versprei.

Infeksie vind hoofsaaklik op blomme, vrugte of lote plaas. Geïnfekteerde blomme kan verlep en afval, wat 'n afname in opbrengs veroorsaak. Siektes wat deur *Botrytis cinerea* veroorsaak word, word dikwels na verwys as "grysskimmel", as gevolg van die fluweelagtige grys spore wat op geïnfekteerde weefsels vorm. Hierdie spore is egter nie altyd in die vroeë stadiums van infeksie teenwoordig nie. Na-oes, kan *Botrytis*-geïnfekteerde areas op vrugte sag en bruin wees, met bruin of grys knoppe en onreëlmatige littekens. Vrugbesering op meer ryp vrugte kan tot kurkagtige riwwe op die vrugoppervlak lei (Fig. 2).

Die optimale omgewingstoestande vir infeksie deur *B. cinerea* is temperature tussen 15 en 20°C (optimaal 18°C), relatiewe humiditeit > 90% en blaar- of vrugnatheid van ≥ 16 uur.

Bestuurs-aanbevelings

Die bestuur van Botrytis-grysskimmel vereis 'n geïntegreerde strategie wat bestuurspraktyke, biologiese en chemiese bestuurmaatreëls insluit.

Bestuurspraktyke. Aangesien hoë relatiewe humiditeit, verminderde lig en matige temperature siekte-ontwikkeling bevorder, is behoorlike snoei van bome noodsaaklik. Dit sal ligpenetrasie verhoog en relatiewe humiditeit in die blaredak verlaag. Gegewe die alomteenwoordige aard en wye gasheerreeks van *Botrytis*, sal inokulumbestuur beperkte voordeel inhou. Stikstof- en kalsiumbemesting moet geoptimiseer word om oormatige vegetatiewe groei te vermy en selwande te versterk.

Biologiese beheer. Die gebruik van swamme, bakterieë en giste om siektes te beheer wat deur *Botrytis cinerea* veroorsaak word, word al meer as 30 jaar bestudeer. Biologiese beheermiddels kan as 'n alternatief vir sintetiese swamdoders gebruik word; hulle is meer omgewingsvriendelik, met 'n laer risiko van weerstand ontwikkeling. Klimaatstoestande moet egter ook die biologiese beheermiddels bevoordeel vir optimale doeltreffendheid.

Chemiese bestuur. Swamdoders is effektief in die bestuur van *Botrytis*-siektes, maar daar kan nie op chemiese beheer staatgemaak word as die enigste bestuurstrategie nie. Weerstand van *Botrytis cinerea* teen verskeie swamdoders, is wêreldwyd aangemeld, en dit is dus noodsaaklik om swamdoders verantwoordelik te gebruik. Daarbenewens, wanneer gewasse oor 'n lang tydperk beskerming benodig as gevolg van opeenvolgende siklusse van blom en vrugset, verhoog die risiko van weerstand. Swamdoders wat tydens volblom en vrugset vir Alternaria-bruinvlekbeheer toegedien word, kan ook 'n effek op *Botrytis*-infeksie van blomme hê.

Die huidige **geregistreerde** beheeropsies vir Botrytis-grysskimmel in Suid-Afrika, word in Tabel 1 gelys.

Tabel 1. Geregistreerde biologiese en chemiese beheeropsies vir Botrytis-grysskimmel (gebaseer op geregistreerde etiketaanbevelings)

Aktiewe bestanddeel	**Dosis**	**Toediening**
Pirimetaniel (anilino-pirimidien)	120ml/100L water	Dien die eerste aanwending met blom toe. Dien die produk in 'n voorkomende swamdoderspuitprogram toe met swamdoders van verskillende FRAC groepkodes, 14 – 21 dae intervalle, afhangende van kultivar en siektedruk. Verseker deeglike spuitbedekking. Dien slegs een keer in die voorkomende Botrytis-bloeiselversengingspuitprogram toe.
Pirimetaniel (anilino-pirimidien) + fludioksoniel (fenielpirrool)	120ml/100L water	Dien die eerste voorkomende bespuiting met blom toe. Dien toe in 'n voorkomende spuitprogram met swamdoders van verskillende FRAC-groepe, in intervalle van 14 tot 21 dae, afhangende van die kultivar en siektedruk. Verseker deeglike spuitbedekking. Dien slegs een keer toe in die voorkomende spuitprogram. Moenie ná vrugset toedien nie.
Azoksistrobien (strobilurien)	20ml/100L water	Dien die eerste toediening met blom toe. Twee (2) – drie (3) toedienings kan in intervalle van 14 – 21-dae toegedien word, afhangende van die kultivar en siektedruk. Verseker deeglike spuitbedekking. Moenie kuratief toedien nie. Indien 'n swamsiekte-spuitprogram 'n FRAC 11-swamdoder ná blom insluit, begin en eindig die Botrytis-beheerprogram met toedienings van geregistreerde swamdoders van 'n ander FRAC-groep.
Trichoderma asperellum stam TRC900	200ml/ha	Blaarbespuiting elke 10-14 dae. Gronddeurdrenk maandeliks. Moet nie met kwaternêre ammonium meng nie.
Bacillus amyloliquefaciens subsp. *plantarum* D747	1kg/ha (4000-6000L water)	Dien toe as 'n voldek bespuiting, maar nie tot afloop nie. Begin toediening by die eerste teken van siekte, of gedurende periodes wat gunstig is vir siekte-ontwikkeling. Fokus die toedienings op blomme. Dien toe in intervalle van 7-dae. Vier tot ses toedienings word aanbeveel.

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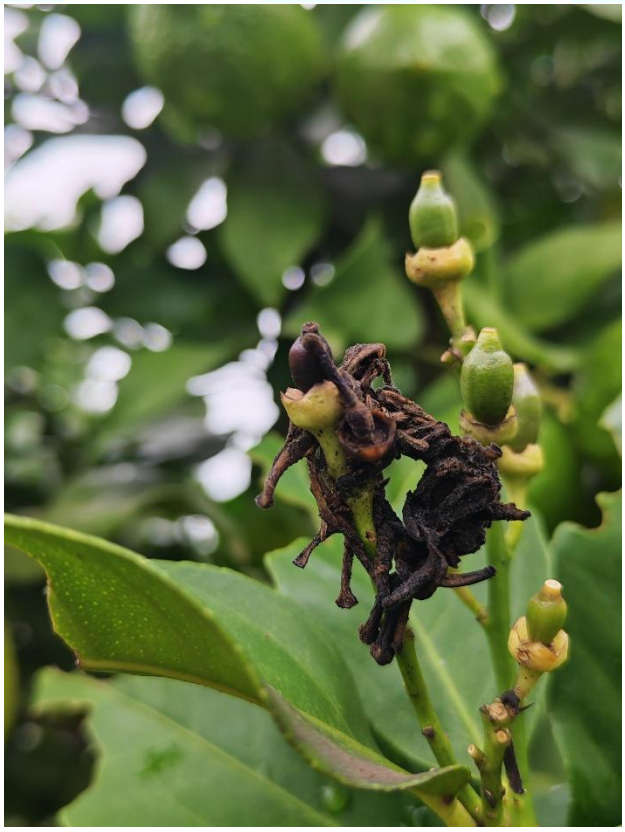
Figuur 1: Skilvervorming-simptome op suurlemoen



Figuur 2: Bloeiselversenging-simptome

BI3 JOU HEFFING WERK VIR JOU - PRODUSENTE SE HEFFINGS WORD AANGEWEND OM DIE AKTIWITEITE VAN DIE CRI TE BEFONDS