



## Management guidelines for Botrytis Grey Mould in Orchards

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*Botrytis cinerea* is the causal agent of flower blight, rind distortion and post-harvest decay of various citrus types.

This Cutting Edge serves to inform growers on the pathogen and disease, and to advise on practices that should be followed to manage Botrytis Grey Mould in orchards.

### The pathogen and disease

Botrytis Grey Mould is caused by the fungal pathogen *Botrytis cinerea*. The pathogen 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 on plant debris such as old leaves, old flowers, mummified fruit, and dead twigs or wood. This material also serves as an inoculum source, as the profuse sporulation of grey spores occur after cool humid conditions.

Infection occurs mainly on flowers, soft young fruits or shoots. Infected flowers may wilt and die, causing a decrease in 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. Fruit injury on more mature fruit can result in corky ridges on the fruit surface.

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

prediction model, based on published research, was programmed in CRI-PhytRisk ([www.cri-phytrisk.co.za](http://www.cri-phytrisk.co.za)), and is currently being validated.

### Management recommendations

Management of Botrytis Grey Mould requires an integrated strategy incorporating cultural practices, biological and chemical control.

**Cultural practices.** Since high relative humidity, reduced light and moderate temperatures favour disease development, **proper pruning of trees is essential.** This will increase light penetration and decrease relative humidity in the tree canopy. Sources of inoculum, such as pruning debris, old leaves, old flowers, mummified fruit, dead twigs and wood, must also be removed from orchards to reduce inoculum load.

**Chemical and biological management.** Fungicides are effective in managing Botrytis diseases, but **chemical control cannot be relied upon as the sole management tool. It is advised that fungicide applications should start at full flower** and that applications are only done when the climate (cool, wet and humid) during flowering is conducive to Botrytis development. 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 of time due to successive cycles of flowering and fruiting, the risk of resistance increases. The currently **registered** control options for Botrytis Grey Mould in South Africa are listed in Table 1. Please note that it is only specific tradenames that are currently registered as indicated below. **It is strongly advised that you use different products (actives or biological products) in a management programme and to not do more than two fungicide applications in a season if not needed.** These recommendations are aimed at preventing resistance development.



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

Active ingredient	Dosage	Application
Pyrimethanil (anilino- pyrimidines)	120 ml/100L water	Apply the first Botrytis flower blight application at blossom. Apply in a preventative fungicide spray programme with fungicides from different FRAC group codes, 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- pyrimidines)  Fludioxonil (phenylpyrrole)  [actives in one product]	120 ml/100L water	Apply the first Botrytis flower blight application at blossom. Apply product in a preventative fungicide spray programme with fungicides from different FRAC group codes, 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	20 ml/100L water	Apply the first preventative Botrytis flower blight application at blossom. Two (2) – three (3) applications can be applied with two to three-week intervals, depending on cultivar and disease pressure. Ensure thorough spray coverage. DO NOT apply the product 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 different FRAC groups.
<i>Trichoderma asperellum</i> * strain TRC900 (At least 1 x 10 <sup>9</sup> cfu/ml)	200ml/ha	Foliar spray every 10-14 days. Soil drench monthly. Do not mix with benomyl, carbendazim or quaternary ammonium.



### Bestuurriglyne vir Botrytis-grysskimmel in Boorde

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*Botrytis cinerea* is die veroorsakende organisme van blomskroei, skilvervorming en na-oes vrot van verskeie sitrustipes. Hierdie Snykant het ten doel om produsente oor die patoogeen en siekte in te lig, en om advies oor praktyke wat gevolg moet word om Botrytis-grysskimmel in boorde te bestuur, te gee.

#### Die patoogeen en siekte

Botrytis-grysskimmel word deur die swampatogeen *Botrytis cinerea* veroorsaak. *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 patoogeen oorleef saprofities as miselia en/of sklerosia op plantreste soos ou blare, ou blomme, gemummifiseerde vrugte, en dooie takkies of hout. Hierdie materiaal dien ook as bron van inokulum aangesien die oorvloedige sporulasie van grys spore ná koel, vogtige toestande voorkom.

Infeksie vind hoofsaaklik op blomme, sagte, jong 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. Vrugbesering op meer volwasse vrugte kan tot kurkagtige riwwe op die vrugoppervlak lei.

Die optimale omgewingstoestande vir infeksie deur *B. cinerea* is temperature tussen 15 en 20°C (optimaal 20°C), relatiewe humiditeit > 90% en benattingsperiode van  $\geq 16$  uur. 'n Botrytis-infeksievoorspellingsmodel, gebaseer op gepubliseerde navorsing, is in CRI-PhytRisk ([www.cri-phytrisk.co.za](http://www.cri-phytrisk.co.za)) geprogrammeer en word tans bekragtig.

#### Bestuurs-aanbevelings

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

*Verbouingspraktyke.* 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. Bronne van inokulum, soos snoei-afval, ou blare, ou blomme, gemummifiseerde vrugte, dooie takkies en hout, moet uit die boord verwyder word om die inokulumlading te verminder.

#### *Chemiese en Biologiese bestuur.*

Swamdoders is effektief in die bestuur van Botrytis-siektes, maar **daar kan nie op chemiese beheer staatgemaak word as die enigste bestuurstrategie nie.** Dit word aanbeveel dat swamodertoedienings met volblom begin en dat toedienings slegs gedoen word wanneer die klimaat (koel, nat en vogtig) tydens blom bevorderlik vir Botrytis-ontwikkeling is. 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. Die huidige **geregistreerde** beheer-opsies vir Botrytis-grysskimmel in Suid-Afrika, word in Tabel 1 gelys. Let daarop dat dit net spesifieke handelsname is wat tans geregistreer is soos onder aangedui. **Dit word sterk aanbeveel om verskillende produkte (aktiewe of biologiese produkte) in 'n bestuursprogram te gebruik, en om nie meer as twee swamdoder toedienings in 'n seisoen te doen indien dit nie nodig is nie.** Hierdie aanbevelings is daarop gemik om weerstandsontwikkeling te voorkom.



**Tabel 1.** Geregistreerde biologiese en chemiese beheerprodukte vir Botrytis-grysskimmel (gebaseer op geregistreerde etiket-aanbevelings)

Aktiewe bestanddeel	Dosis	Toediening
Pirimetaniel (anilino- pirimidie)	120ml/100L water	Dien die eerste Botrytis-bloeiselversenging-toediening met blom toe. Dien die produk in 'n voorkomende swamdoderspuitprogram toe met swamdoders van verskillende FRAC groepkodes, 14 – 21 dae intervalle, afhange van kultivar en siektedruk. Verseker deeglike spuitbedekking. Dien slegs een keer in die voorkomende bloeiselversengingspuitprogram toe.
Pirimetaniel (anilino- pirimidie)  Fludioxonil (fenielpirrool)  [aktiewe in een produk]	120 ml/100L water	Dien die eerste Botrytis-bloeiselversenging-toediening met blom toe. Dien die produk in 'n voorkomende swamdoderspuitprogram toe met swamdoders van verskillende FRAC groepkodes, 14 – 21 dae intervalle, afhange van kultivar en siektedruk. Verseker deeglike spuitbedekking. Dien slegs een keer in die voorkomende Botrytis-bloeiselversengingspuitprogram toe. Moenie ná vrugset toedien nie.
Azoxystrobien	20 ml/100L water	Dien die eerste voorkomende Botrytis-bloeiselversenging-toediening met blom toe. Twee (2) – drie (3) toedienings kan met twee tot drie weke intervalle toegedien word, afhange van kultivar en siektedruk. Verseker deeglike spuitbedekking. MOENIE die produk kuratief toedien nie. Indien 'n swamsiekte spuitprogram 'n FRAC 11 swamdoder ná blom insluit, begin en eindig die Botrytis-bloeiselversenging beheerprogram met toedienings van geregistreerde swamdoders uit verskillende FRAC groepe.
<i>Trichoderma asperellum</i> isolaat TRC900 (Minstens 1 x 10 <sup>9</sup> cfu/ml)	200ml/ha	Blaarbespuiting elke 10-14 dae. Grondrenking maandeliks. Moet nie met benomiël, karbendasim of kwaternêre ammonium meng nie.