



Management of imazalil concentration in fungicide baths

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The citrus industry's most important post-harvest fungicide against *Penicillium digitatum* (green mould) and *P. italicum* (blue mould), imazalil, has always been applied in a citrus packhouse either in a hot water dip treatment (750 WSP or WG formulation), or in a wax application (EC formulation).

In the dip treatment, the imazalil concentration was always measured by means of a **titration** and the concentration was then topped up accordingly.

When the first signs of *Penicillium* resistance to imazalil were detected in 1999, and with the registration of guazatine against sour rot, green and blue mould, the recommendation for the dip treatment was changed to a mixture of imazalil and guazatine in a hot water bath. These two fungicides have different modes of action, and when used in a mixture or alternation, would limit fungicide resistance development.

However, in the mixture of the two compounds, guazatine interfered with the titration of imazalil, and the imazalil concentration could not be diligently monitored through the use of this method. A **topping-up** procedure was then recommended to maintain adequate concentrations of the two fungicides in the mixture.

Unfortunately, this vitally important **critical control point** in the application of these two important fungicides was **not managed** correctly for the following reasons:

1. Insufficient exposure (less than 30 s) of the fruit to the fungicide/s in the hot water bath due to the following:
 - **The vast majority of fungicide baths are too short.**
 - **Large amounts of fruit move through the bath too rapidly during peak production and some fruit often 'ride' on top of other fruit in the bath and barely come into contact with the fungicide/s.**

2. Incorrect topping-up procedures.
3. Packhouses do not make use of the imazalil titration, when not using guazatine in the fungicide bath (guazatine not permitted in certain markets).

The history of the results from imazalil residue analyses has clearly demonstrated that the vast majority of packhouses only attain a level of **<1.0 mg/kg (ppm)** of imazalil on their export fruit, resulting in high waste levels from green and blue mould in the markets.

Packhouses ideally need to be attaining imazalil residue levels of **2-3 mg/kg** on export fruit to prevent infection and sporulation. Sporulation inhibition is imazalil's best property and contributes substantially to postharvest green and blue mould control as it prevents the spread of infection in cartons and also reduces fungicide resistance development through selection for resistant spores.

N.B. WE NEED TO MANAGE THE APPLICATION OF OUR MOST IMPORTANT FUNGICIDE, IMAZALIL, MORE EFFECTIVELY.

Therefore, during the February 2008 "Packhouse Workshops" the following **new recommendation** for the application of imazalil and guazatine was made:

- Apply **imazalil** separately in the hot water bath and make use of the **imazalil titration technique** to measure its concentration at regular intervals. Top up accordingly by using the formula.

The titration must be conducted 3-5 times every day during packing. Records of the titration results must be retained on file for reference.

- Those packhouses using guazatine must use one of the guazatine-wax formulations (Deccowax or Citriwax). In these cases, do not apply guazatine in the bath with imazalil.



Cutting Edge

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Titration Chemicals and glassware for titration

Available from **Labchem** Johannesburg

Tel. 011 452 1116

Fax. 011 452 1122

Email labchem@netactive.co.za

Contact person: D. Stott

Negotiations are underway with Protea Chemicals to make up the chemicals as well. Packhouses will be advised when finalised.

Titration Procedure

Refer to the "Production Guidelines" or to CRI.



Bestuur van imazalil konsentrasie in fungisiedbaddens

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Imazalil, die sitrusbedryf se belangrikste na-oes swamdoder teen *Penicillium digitatum* (groenskimmel) and *P. italicum* (blouskimmel), is òf in 'n warmwater doopbehandeling (750 WSP of WG formulاسie), òf in sitruswaks (EC formulاسie) in sitruspakhuis aangewend.

Die imazalil konsentrasie in die doopbehandeling is deur gebruik van 'n titrasie metode gemeet en dan daarvolgens aangepas deur aanvulling.

Met die eerste tekens van *Penicillium* bestandheid teen imazalil in 1999, en die registrاسie van guazatine teen suurvrot en groen- en blouskimmel, is die aanbeveling vir die doopbehandeling in die warmbad verander na 'n mengsel van imazalil en guazatine. Hierdie swamdoders het verskillende metodes van werking en die gebruik daarvan in 'n mengsel kan die ontwikkeling van swamdoder bestandheid beperk.

Guazatine belemmer egter die titrasie van imazalil, en gevolglik kon die imazalil konsentrasie nie sorgvuldig met behulp van die titrasie-metode beheer word nie. Die konsentrasies van die twee swamdoders in die mengsel is deur gebruik van 'n aanvullingsformule volhou.

Hierdie uiters belangrike **kritiese beheerpunt**, met die aanwending van hierdie twee belangrike swamdoders, is ongelukkig vir die volgende redes nie sorgvuldig bestuur nie:

1. Onvoldoende blootstelling (minder as 30 s) van vrugte aan die swamdoder/s in die warmwaterbad te wyte aan:
 - die meerderheid swamdoderbaddens is te kort.
 - groot getalle vrugte beweeg te vinnig tydens piek produksie deur die bad en soms 'ry' van die vrugte bo-op mekaar in die bad en die vrugte kom nie eers in aanraking met die swamdoder mengsel nie.
2. Verkeerde aanvullings prosedures.

3. Pakhuise maak nie gebruik van die imazalil titrasie nie, sodra hulle guazatine nie in die swamdoderbad gebruik nie.

Historiese imazalil residu-ontledings wys duidelik dat die meerderheid pakhuis 'n imazalil residu-vlak van **< 1.0 mg/kg (dpm)** op hul vrugte behou en dit veroorsaak hoë vlakke van groen en blouskimmel besmetting tydens aankoms in die mark. Die ideale imazalil residu vlakke wat pakhuis moet bereik op uitvoer vrugte is **2-3 mg/kg** om bederf en sporulasie te verhoed. Sporulasie inhibisie is imazalil se beste eienskap. Dit dra by tot na-oes groen en blouskimmel beheer, verhoed die verspreiding van besmetting in kartonne en beperk ontwikkeling van imazalil bestandheid.

N.B. ONS MOET DIE TOEDIENING VAN ONS BELANGRIKSTE SWAMDODER, IMAZALIL, MEER EFFEKTIEF BESTUUR.

Daarom is die volgende nuwe aanbeveling tydens die Februarie 2008 "Pakhuis Werkswinkels" oor die toediening van imazalil en guazatine gemaak:

- Gebruik **imazalil** alleen in die warmwaterbad en maak gebruik van die **imazalil titrasie-tegniek** om die konsentrasie te bepaal en daarna volgens die aanvullingsformule die konsentrasie aan te pas.

Die titrasie moet 3-5 keer gedurende elke dag van pak gedoen word, en rekords moet van hierdie resulate gehou word.

- In pakhuis wat guazatine wil gebruik, kan die guazatine-waks formulاسies (Deccowax of Citriwax) gebruik word. In hierdie geval, moet guazatine nie in die bad met imazalil gemeng word nie.

Titrasie-chemikalieë en glasware

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Onderhandelinge is ook met Protea Chemicals gedoen om hierdie chemikalieë te verskaf. Pakhuise sal hiervan in kennis gestel word.

Titrasie prosedure

Verwys na "Produksie Handleiding" of na CRI.