The Cutting Edge

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Post Harvest Fungicide Resistance

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Pathogen resistance to post harvest fungicides in citrus production has always been a threat and is in fact occurring with certain pathogens and fungicides at present.

Thiabendazole (TBZ) and Benlate belong to the benzimidazole group of fungicides which all have the same mode of action. The benzimidazoles (except TBZ) were used intensively for years for blackspot control, by means of pre-harvest orchard sprays. In this way, selection pressure was exerted on the naturally occurring benzimidazole resistant green and blue mould spore populations. Where orchard sanitation was poor, millions of spores were present on fruit surfaces. Where control of fruit flies and false codling moth was inadequate, the incidence of rind injuries was high. The benzimidazole residues on the fruit inhibited most of the spores but did not prevent the benzimidazole resistant spores from infecting the fruit. This allowed millions more resistant spores to be produced. These resistant spores were then carried over, on harvested fruit, into the packhouse and treated with TBZ. Millions more resistant spores were produced until eventually the entire spore population became resistant.

The evaluation of post harvest pathogens for resistance to the post harvest fungicides is done randomly by OCC on an ongoing basis from season to season. Isolates of *Diplodia* (stem-end rot) have been made from infected fruit and screened against TBZ and Benlate. Resistant isolates of this pathogen have also been picked up. Spore samples of the *Penicillium* moulds (green and blue mould) have also been randomly screened against Imazalil and up until this season, no signs of resistance to Imazalil had been seen.

However, spore samples of both *Penicillium digitatum* (green mould) and *Penicillium italicum* (blue mould) from Zimbabwe and W. Cape (Citrusdal area) were submitted to OCC this season for screening due to the high infestation of these pathogens on export citrus from these two areas. These samples were screened against Imazalil and a small proportion of two samples were found to contain resistant spores in both cases.

Further screening revealed that these resistant spores could be inhibited by higher concentrations of Imazalil so a control strategy can be proposed and implemented, in both production areas, to prevent full scale resistance from occurring.

Nevertheless, we have a potential “time bomb” situation here. This is the first case of Imazalil resistant *Penicillium* spores being reported in the southern African Citrus production areas and if the necessary precautions and preventative measures are not taken, full scale resistance to Imazalil could occur, in time, and the loss of the fungicide Imazalil would be disastrous for the citrus industry.

Strategies to prevent a resistance problem

(a) Pre harvest disease control

It is undesirable to use fungicides with the same mode of action for pre- and post harvest disease control.

(b) Orchard hygiene

A certain threshold concentration of fungal spores in a wound is necessary before a fruit will rot. Normally there are not enough fungicide resistant spores in the natural environment for this threshold to be reached. It has, however, been shown that fungicide-sensitive spores can help small numbers of fungicide resistant spores to cause fruit rot. Therefore it is essential that the total spore load on the fruit be kept as low as possible.

Fallen fruit should therefore be removed from the orchard twice a week before any mould spores are formed on the fruit surface.

(c) Insect control

Fruit-attacking insects must be controlled in order to avoid the creation of infection sites on the fruit for blue and green mould and the sour rot fungus.

(d) Chlorination of dump tanks and the fruit washing process

To further reduce the spore load on fruit surfaces, the dump tank water should be thoroughly chlorinated. Where fruit is dumped dry, the first set of brushes must not be allowed to become a source of infection by concentrating spores that are brushed from the fruit surface. Fruit should be washed with a detergent containing a fungicide (e.g. Deccosol) or chlorine, or rinsed with chlorinated water. Water in dump tanks and fungicide baths should be changed when necessary to prevent a build-up of spores. Avoid allowing rotten fruit to settle in these baths.

(e) Prompt treatment of fruit after harvest

Fruit should be treated promptly after harvest to prevent sporulation of green and blue mould on fruit in lugboxes or trailers. This will prevent a high spore load on fruit going into the packhouse.

(f) The use of mixtures of fungicides

Where resistance to any one component of a fungicide mixture has not been detected, the use of fungicide mixtures with different modes of action will greatly retard the onset of resistance problems. Resistance to guazatine and sodium ortho-phenylphenate (SOPP) has not yet been detected in South Africa. The incidence of imazalil resistance is still very low. TBZ-resistant strains of blue and green mould have been isolated in most production areas.

(g) Alternation of fungicides

It has been established that a fitness cost is attached to resistance by green mould biotypes to imazalil or TBZ. In other words, the resistant biotypes cannot compete successfully with fungicide-sensitive ones in the absence of that fungicide, and the numbers of resistant biotypes will gradually decrease as long as this fungicide is not used.

This phenomenon enables one to still use a certain fungicide effectively, even though resistant strains of pathogens are present. Withdraw the use of the fungicide at risk, using another fungicide with a different mode of action until the number of resistant spores is very low or cannot be detected any more, then re-introduce the first fungicide and withdraw the second one. This cycle is then repeated.

A fitness cost is not always associated with resistance and every pathogen-fungicide interaction must be evaluated on its own.

(h) Sanitation in the packhouse, cold rooms and degreening rooms

Production of spores on fungicide-treated fruit should be avoided at all costs in the packhouse, cold rooms and degreening rooms. Store local market fruit in another building, see to it that factory-bound fruit is removed regularly and destroy fungicide-treated culled fruit before spores are formed on them.

Do not repack fruit rejected for decay at the ports or at inland packhouses. If wasty fungicide-treated fruit is repacked in an inland packhouse, the whole packhouse should be sanitized thoroughly immediately after completing the exercise or every night, whichever is sooner. The same applies to Valencias stored for sale in late summer.

Degreening of citrus, in degreening chambers, has become an integral part of citrus production in Southern Africa. Multiple exposure of citrus to fungicides in a pre-degreening drench and thereafter packhouse treatments is a very important aspect of the process. If not conducted in a proper and correct manner, this exposure to the fungicides could lead to resistance problems occurring. The following practices should be specifically avoided:

- using Imazalil in the pre-degreening drench as well as in the packhouse treatment;
- returning degreened fruit from the packhouse, after treatment, to the degreening process for a second time.

It is important to note that resistant spores could be detected at any one packhouse at any inopportune point in time as has already occurred. This would impact largely on the particular packhouse concerned in that a new packhouse strategy would have to be devised so as to prevent full scale resistance occurring. More importantly though, the citrus industry as a whole would be exposed to the possibility of widespread resistance. In this instance the fungicide Imazalil is at risk and if resistance to Imazalil eventually occurs throughout, this could spell disaster for the industry.

We appeal to all role players to co-operate in this matter as this would be in the interests of the entire citrus industry.

Intervention thresholds for citrus thrips *Scirtothrips aurantii* on citrus fruit

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Summary

Intervention thresholds have been developed for

citrus thrips. These thresholds are based on fruit infestation and are aimed at preventing more than 1% of the crop from being culled from export due to damage caused by citrus thrips. The thresholds increase with time during the first 12 weeks after petal fall due to a decrease in susceptibility to damage.

Introduction

Citrus thrips is an indigenous pest with many alternative host plants in southern Africa. Although this pest can deform and stunt new growth, its main threat is cosmetic damage to the fruit, which results in down-grading. Citrus thrips is the key pest in the integrated pest management of citrus in most of southern Africa. This is because the choice of insecticide used to control this pest will greatly influence the degree of biocontrol achieved against other pests.

An intervention threshold to prevent more than 1% export cull was developed by Samways (1986) for adult thrips caught on Saturn Yellow sticky traps. A more convenient system involving sticky yellow card traps was later introduced by Grout and Richards (1990). Trapping adult citrus thrips before bloom can be useful in determining relative differences in population densities between blocks. This information can be used in making decisions on what thripicides should be used. Traps are also valuable later in the season to determine the degree of risk from late populations of citrus thrips.

During the three months after petal fall, low infestation levels of thrips larvae can severely damage fruit and under certain weather conditions, numbers of adult citrus thrips caught on traps do not adequately represent populations of larvae on the fruit. For this reason, research towards the development of an intervention threshold for larval infestation of fruit was initiated.

Materials and methods

Between 1994 and 1999, data on the relationship between citrus thrips infestation of fruit and resultant damage were gathered. Most of these data were collected from grapefruit and navel orange orchards but a few mid-season and Valencia orchards were also included. Orchards from the Northern Province, Mpumalanga, the Eastern Cape and Swaziland were used. At all times, the sepals of the calyx were lifted to look for thrips. During the last season, scout records of thrips infestation from three different farms were compared with our assessment of thrips damage in the same orchards. Damage was assessed just before harvest. Damage was rated as: culled from Category 1 export fruit, scarred (but within Category 1), or clean. Attempts were then made to relate citrus thrips infestation levels earlier in the season to the degree of damage at harvest.

Combining all these data, provisional intervention thresholds were determined for different periods after petal fall which would result in more than 1% cull from export if the thresholds were exceeded and no action was taken within a week to reduce population numbers.

Results and discussion

Regression equations for the first four weeks after petal fall were developed but this was not possible for later periods due to smaller data-sets and more variability. The relationship between fruit scarring and thrips infestation determined by pest scouts was especially variable due possibly to low numbers of fruit used in scouting, different trees used for evaluation of thrips infestation and damage, and irregular scouting which may have missed peak thrips infestations. Based on these results, a sample size of 50 fruit from five trees per hectare should be considered a minimum. Accuracy will be improved if fixed data trees are used for monitoring, or when trees are selected haphazardly, the same total number of fruit should be inspected on 10 trees per hectare rather than five. With experience, data trees or additional inspection trees could be selected where thrips are known to be more abundant, e.g., near a *Grevillea* windbreak.

It became apparent that low numbers of citrus thrips present for more than a week could cause as much damage as a higher number of thrips for a shorter period of time. It was therefore considered necessary to have an intervention threshold based on an average infestation level over a fortnight in addition to the weekly infestation threshold (Table). The intervention thresholds increase with time from the fifth week after petal fall because the fruit becomes less susceptible to damage as it expands. Fruit are most susceptible to damage between the second and fourth week after petal fall when the calyx makes contact with the fruit. Action should be taken to reduce citrus thrips populations within one week after the threshold levels have been exceeded.

The intervention thresholds provided serve as guidelines and are dependent on good scouting. The thresholds may have to be fine tuned for certain climatic conditions and cultivars, for example, Valencias in a cold climate may require slightly higher numbers of thrips to cause more than 1% export cull. Scouting is more reliable when emphasis is placed on larval infestation of fruit because they are less mobile than the adults and are responsible for more of the scarring. However, scouting for thrips larvae will require lifting the calyx with a flat, blunt object. If fresh damage is evident and no thrips are visible the fruit can be considered to be infested. If only low numbers of thrips larvae are present yet numbers of adults are high, the second and fourth columns of intervention thresholds in the table for both adults and larvae can be used.

Acknowledgements

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Table. Suggested intervention thresholds for citrus thrips on citrus fruit*. To prevent more than 1% export cull, treatments should be applied when these numbers are exceeded.

Damage risk period	Mean infestation over 1 week		Mean infestation over 2 weeks	
	Fruit with larvae (%)	Fruit with adults or larvae (%)	Fruit with larvae (%)	Fruit with adults or larvae (%)
PF - 4 wks	2	4	1	2
5 - 6 wks	3	6	2	4
7 - 8 wks	4	8	3	6
9 - 10 wks	5	10	4	8
11 - 12 wks	6	12	5	10

* Scouts should look under the calyx of each fruit otherwise infestation will be underestimated.

Die Snykant

SITRUSNAVORSINGSNUUS VAN OUTSPAN SITRUSSENTRUM

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Na Oes Swamdoder Weerstandbiedendheid

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Patogeen weerstandbiedendheid teen na oes swamdoders in sitrusproduksie was altyd 'n bedreiging en kom tans voor met seker patogene en swamdoders.

Thiabendasool (TBZ) en Benlate behoort aan die bensimidasool groep swamdoders wat almal dieselfde metode van aksie het. Die bensimidasole (behalwe TBZ) is jare lank intensief gebruik vir swart vlek beheer deur middel van voor oes boordbespuitings. Op hierdie wyse is seleksiedruk uitgevoer op die bensimidasoolbestande groen- en blouskimmelspoor-bevolking, wat natuurlik voorkom. Weens swak boordsanitasie was miljoene spore teenwoordig op vrugoppervlakke. Swak insekbestryding het veroorsaak dat beserings in die skil van die vrugte ontstaan het. Die bensimidasool residu’s op vrugte het die meeste spore inhibeer maar het nie voorkom dat die bensimidasool bestande spore verrotting veroorsaak nie. Dit het gelei tot die ontstaan van miljoene addisionele bestande spore. Hierdie bestande spore is oorgedra, op geoesde vrugte, in die pakhuis en verder behandel met TBZ. Dit het tot ‘n verdere selektiewe inhibering van die sensitiewe spore gelei, en toe is miljoene meer bestande spore geproduseer wat uiteindelik gelei het tot die weerstandbiedendheid van die hele spoor populasie.

Die evaluering van na-oes patogene vir weerstandbiedendheid teen na-oes swamdoders word op ‘n gereelde basis deur OCC gedoen. Isolate van Diplodia (stingelend vrot) is, van besmette vrugte af getoets teen die bensimidasool swamdoders. Hier is bestande spore van Diplodia ook opgelet. Spoor monsters van groen- en blouskimmel is gedurig getoets teen Imazalil en tot en met die 1998 seisoen is geen tekens van bestande spore opgemerk nie.

Spoor monsters van albei *Penicillium digitatum* (groenskimmel) en *Penicillium italicum* (blouskimmel), van Zimbabwe en die W. Kaap (Citrusdal gebied), is by OCC ingedien hierdie seisoen (1999) vir evalueering teen Imazalil, weens die hoë infestasie van hierdie patogene op uitvoer vrugte in hierdie twee gebiede. Hierdie monsters is getoets teen Imazalil en ‘n klein persentasie bestande spore is ontdek in twee monsters, van albei produksie gebiede.

Verdere toetse het gewys dat hierdie bestande spore deur hoër konsentrasies van Imazalil inhibeer kon word. Dus kan ‘n beheer strategie voorgestel en geïmplementeer word in beide produksie gebiede om volskaalse weerstandbiedendheid te voorkom.

Nieteenstaande, het ons 'n potensiale "tydbom" situasie hier. Dit is die eerste geval van Imazalil weerstanbiedendheid wat vermeld word in die Suid Afrikaanse Sitrus produksie gebiede en as die nodige voorsorg- en voorkomingsmaatreëls nie geneem word nie, kan ‘n volskaalse weerstandbiedendheid teen Imazalil mettertyd ontstaan, en die verlies van Imazalil kan rampspoedig wees vir die sitrus nywerheid.

Strategië om 'n weerstand probleem te voorkom

(a) Vooroes siekte beheer

Dit is onwenslik om swamdoders met dieselfde metode van aksie te gebruik vir voor- en na-oes siekte beheer.

(b) Boordhigiëne

'n Sekere drempelkonsentrasie van swamspore in 'n wond is nodig voordat 'n vrug sal verrot. Gewoonlik is daar nie genoeg swamdoderweerstanbiedende spore in die natuurlike omgewing om hierdie drempel te bereik nie. Dit is wel bewys, dat swamdoder sensitiewe spore klein getalle weerstandbiedende spore kan help om vrugverrotting te veroorsaak. Daarom is dit noodsaaklik dat die totale aantal spore op die vrug so laag moontlik gehou word.

Afgevalle vrugte moet dus twee maal per week uit die boord verwyder word, voordat enige swamspore op die oppervlak van die vrugte vorm.

(c) Insekbeheer

Insekte wat vrugte aanval moet beheer word om steekplekke te voorkom wat toegang vir blou- en groenskimmel en die suurvrot swam verleen.

(d) Chloorbehandeling van dompel tenks en die vrug-was proses

Om die spoorlading te verminder op vrugoppervlakke moet dompeltenk water deeglik gechloreer wees. Waar vrugte droog gedompel word, moet die eerste stel borsels nie toegelaat word om ‘n bron van infeksie te word deurdat spore wat van die vrugte afgeborsel word, daarin versamel nie. Vrugte moet met ‘n ontsmettingsmiddel gewas word wat ‘n swamdoder bevat (bv. Deccosol) of chloor, of moet met gechloreerde water afgespoel word. Water in dompel tenks en swamdoder baddens behoort verander te word wanneer nodig om ‘n opbou van spore te voorkom. Vermy die opgaar van verrote vrugte in hierdie baddens.

(e) Onmiddelike behandeling van vrugte na oes

Vrugte behoort na oes dadelik behandel te word om te voorkom dat spoorvorming van groen- en blouskimmel op vrugte in plukkiste of sleepwaentjies plaasvind. Dit sal 'n hoë spoorlading op vrugte wat in die pakhuis in gaan voorkom.

(f) Die gebruik van swamdodermengsels

Indien geen bestandheid teen enige een komponent van 'n swamdoder mengsel vasgestel is nie, sal die gebruik van swamdodermengsels met verskillende modes van aksie grootliks die aanval van weerstand probleme vertraag. Weerstand teen guazatine, imazalil en natrium orto-fenielfenaat (NOFF) is nog nie in Suid Afrika opgespoor nie. TBZ-weerstandbiedende rasse van blou- en groenskimmel is geïsoleer in meeste produksie gebiede.

(g) Afwisselling van swamdoders

Dit is vasgestel dat 'n oorlewings koste geheg kan word aan weerstand deur groenskimmel bio-tipes teen imazalil of TBZ. Met ander woorde, die weerstanbiedende bio-tipes kan nie suksesvol wedywer met swamdodergevoelige bio-tipes in die afwesigheid van hierdie swamdoder nie, en die getalle van weerstanbiedende bio-tipes sal geleidelik afneem solank hierdie swamdoder nie gebruik word nie.

Hierdie verskynsel stel mens in staat om steeds effektief gebruik te maak van 'n sekere swamdoder hoewel weerstanbiedende rasse van patogene aanwesig is, deur die gebruik van die swamdoder terug te trek, en 'n ander swamdoder te gebruik wat 'n ander mode van aksie het totdat die aantal weerstanbiedende spore baie laag of nie meer opgespoor kan word nie, en dan die eerste swamdoder herbekend te maak en die tweede een terug te trek. Hierdie siklus word dan herhaal.

'n Oorlewings koste word nie altyd geassosieer met weerstandbiedendheid nie en elke pathogen-swamdoder interaksie moet afsonderlik geëvalueer word.

(h) Sanitasie in die pakhuis, koel kamers en ontgroenings kamers

Produksie van spore op swam-behandelde vrugte behoort ten alle koste vermy te word in die pakhuis, koel kamers en ontgroenings kamers. Stoor vrugte bestem vir die plaaslike mark in 'n ander gebou, verseker dat fabriek-besteme vrugte gereeld verwyder word en vernietig swamdoder-behandelde uitskotvrugte voordat spore op hulle gevorm word.

Moet nie vrugte wat afgekeur is vir verrotting by hawens of by binnelandse pakhuise herverpak nie. As bedorwe swamdoderbehandelde vrugte by 'n binnelandse pakhuis herverpak word, behoort die hele pakhuis onmiddelik deeglik ontsmet te word na voltooiing van die oefening of elke nag, watter ook al die vroegste is. Dieselfde is van toepassing op Valencias gestoor vir uitverkoping in die laat somer.

Ontgroening van sitrus in ontgroenings kamers het ‘n intergrerende deel van sitrus produksie in Suiderlike Afrika geword. Veelvoudige blootstelling van sitrus aan swamdoders in ‘n voorontgroenings bad en daarna aan pakhuisbehandelings is ‘n belangrike deel van die proses. Indien nie behoorlik en presies uitgevoer nie, kan die blootstelling aan die swamdoders lei tot weerstandbiedendheids probleme. Die volgende praktyke moet vermy word :

- die gebruik van Imazalil in die voorontgroenings bad sowel as die pakhuis behandeling;

- verplaasing van ontgroende vrugte van die pakhuis, na behandeling, weer in die ontgroenings kamers vir ‘n tweede keer.

Neem kennis dat bestande spore enige oomblik by enige pakhuis kan ontdek word. Dié sal wel ‘n uitwerking hê op die spesifieke pakhuis om rede ‘n strategie vir die voorkoming van volskaalse bestandheid ingestel sal moet word. Meer belangrik is dat die sitrus bedryf in die algeheel blootgestel sal word aan die moontlikheid van volskaalse weerstandbiedendheid. In dié geval sal Imazalil in gevaar wees. Tensy volskaalse bestandheid teen Imazalil wel gebeur kan dit rampspoedige nagevolge vir die hele sitrus bedryf inhou.

Ons doen ‘n beroep aan alle rolspelers vir hulle samewerking in hierdie saak, aangesien dit in die belange van die hele sitrus bedryf is.

Behandelingsdrempelwaardes vir sitrusblaaspootjie, *Scirtothrips aurantii*, op sitrusvrugte.

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Opsomming

Behandelingsdrempelwaardes wat op vrugbesmetting gebaseer is, is ontwikkel vir sitrusblaaspootjie, *Scirtothrips aurantii*, 'n sleutelplaag in geïntegreerde plaagbestuur van sitrus in die meeste sitrusproduserende gebiede in suidelike Afrika. Dié drempelwaardes is op vrugbesmetting gebaseer en gee vroeë waarskuwing van blaaspootjiebesmettings wat potensieel meer as 1% van die oes ongeskik vir uitvoer kan maak. Die drempelwaardes verhoog namate die vrugte minder vatbaar raak vir blaaspootjiebeskadiging gedurende die eerste 12 weke na blomblaarval.

Inleiding

Sitrusblaaspootjie, *Scirtothrips aurantii* Faure, is 'n inheemse plaag in suidelike Afrika met baie verskillende gasheerplante (Faure 1929). Hoewel dié plaag groeisel kan misvorm en verdere groei kan strem, is kosmetiese skade die belangrikste bedreiging wat tot afgradering van vrugte kan lei. Sitrusblaaspootjie is die sleutelplaag in die geïntegreerde plaagbestuur van sitrus in die grootste gedeelte van suidelike Afrika. Dit is omdat die soort insekdoder wat gebruik word om hierdie plaag te bestry, grootliks die sukses van biologiese beheer teen ander plae beïnvloed.

'n Behandelingsdrempelwaarde vir volwasse blaaspootjies op klewerige Saturnusgeel-plaatlokvalle, wat daarop gemik is om minder as 1% vruguitskot te gee, is deur Samways (1986) ontwikkel. 'n Geriefliker stelsel wat kleiner, klewerige geel kaartlokvalle behels, is later deur Grout & Richards (1990a) bekendgestel. Die monitering van volwasse sitrusblaaspootjie vóór blom kan nuttig wees om relatiewe verskille in bevolkingsdigthede tussen boorde te bepaal. Dié inligting kan gebruik word om te besluit welke insekdoder gebruik behoort te word. Kaartlokvalle is ook waardevol om die potensiële gevaar van sitrusblaaspootjiebevolkings later in die seisoen te bepaal.

Onder sekere weerstoestande is die aantal volwasse sitrusblaaspootjies wat op kaartlokvalle gevang word, nie 'n goeie weerspieëling van die larwebevolking op die vrugte nie. Veral tydens die eerste drie maande na blomblaarval kan klein getalle blaaspootjielarwes groot vrugskade aanrig. Om hierdie rede is navorsing vir die ontwikkeling van 'n behandelingsdrempelwaarde vir larwebesmetting op vrugte, ingelei.

Proeftegniek

Tussen 1994 en 1999 is die verwantskap tussen sitrusblaaspootjies op vrugte en die gevolglike skade bestudeer. Meeste van die data is in pomelo- en nawellemoenboorde, asook 'n paar middelseisoen- en valenciaboorde, versamel. Boorde in die Noordelike Provinsie, Mpumalanga, Oos-Kaap en Swaziland is gebruik. Die kelkblare van vrugte is deurgaans gedurende ondersoeke opgelig om blaaspootjies te soek. Tydens die laaste seisoen is verkenningsrekords van blaaspootjiebesmettings van drie verskillende plase vergelyk met die skrywers se beoordeling van blaaspootjiebeskadiging in dieselfde boorde. Skade is voor oes beraam en as volg geklassifiseer: Letsels wat Kategorie 1 vrugte sal afkeur vir uitvoer, beskadigde vrugte (maar steeds toelaatbaar as Kategorie 1 uitvoervrugte), of skoon vrugte. Sitrusblaaspootjiebesmettingsvlakke vroeër in die seisoen is ook met beskadigingsvlakke op die vrugte met oestyd vergelyk.

Deur al die data te kombineer, is voorlopige behandelingsdrempelwaardes bepaal vir verskillende tydperke na blomblaarval. Oorskryding van die drempelwaardes sal lei tot meer as 1% uitskot van uitvoervrugte as geen aksie binne 'n week geneem word om blaaspootjiegetalle te verminder nie.

Resultate en bespreking

Regressievergelykings vir die eerste vier weke nadat blomblaarval is ontwikkel, maar dit was nie moontlik vir later tydperke nie, weens minder data en groter wisselvalligheid. Die verwantskap tussen vrugletsels en blaaspootjiebesmettings bepaal deur plaagverkenners, was veral wisselvallig, moontlik omdat relatief min vrugte gedurende verkenning gebruik was, verskillende bome gebruik is vir die evaluasie van blaaspootjiebesmettings en beskadiging, asook ongereelde verkenning wat moontlik die piektye van blaaspootjiebesmettings misgeloop het. Gebaseer op die resultate, behoort 'n monstergrootte van 50 vrugte op vyf bome per hektaar as 'n minimum beskou te word. Groter akkuraatheid sal verkry word as vaste databome vir ondersoekdoeleindes gebruik word. Indien bome lukraak gekies word, moet 50 vrugte op 10 bome per hektaar ondersoek word, eerder as op vyf. Soos ervaring opgedoen word, kan databome, of bykomende ondersoekbome, op plekke gekies word waar meer blaaspootjies voorkom, bv. naby *Grevillea* windlanings.

Dit het duidelik geword dat indien 'n klein aantal sitrusblaaspootjies vir langer as 'n week aanwesig is, net soveel skade aangerig kan word as wanneer meer blaaspootjies vir 'n korter tydsduur voorkom. Daar is vervolgens besluit om die drempelwaarde op 'n gemiddelde besmettingsvlak oor 'n 14 dae tydperk te baseer, benewens die weeklikse besmettingsdrempelwaarde (Tabel). Die behandelingsdrempelwaardes verhoog met tyd vanaf die vyfde week na blomblaarval omdat die vrugte minder vatbaar word vir skade soos hulle uitswel. Vrugte is die vatbaarste vir beskadiging tussen die tweede en vierde week na blomblaarval wanneer die kelkblare kontak begin maak met die vrug. Daar moet opgetree word om sitrusblaaspootjiegetalle te verminder binne een week nadat die drempelwaardes oorskry is.

Die behandelingsdrempelwaardes wat voorsien word is bedoel as riglyne en is afhanklik van goeie verkenning. Die drempelwaardes kan wysiging benodig vir sekere klimaatstoestande en kultivars, byvoorbeeld, valencias in 'n koue klimaat kan effe hoër getalle blaaspootjies verdra voordat meer as 1% vruguitskot veroorsaak word. Verkenning is betroubaarder wanneer die klem op vrugbesmetting deur blaaspootjielarwes geplaas word, omdat hulle minder beweeglik as die volwassenes is en vir meer letsels verantwoordelik is. Verkenning vir blaaspootjielarwes vereis egter die oplig van die kelkblare met 'n plat, stomp voorwerp. As vars letsels opgemerk word, alhoewel geen blaaspootjies op die vrugte sigbaar is nie, moet die vrug as besmet beskou word. As daar min blaaspootjielarwes en baie volwassenes aanwesig is, kan die tweede en vierde kolomme van behandelingsdrempelwaardes in die tabel vir beide volwassenes en larwes gebruik word.

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Tabel. Voorgestelde behandelingsdrempelwaardes vir sitrusblaaspootjies op sitrusvrugte*. Om meer as 1% uitskot van uitvoervrugte te verhoed, behoort behandeling toegepas te word wanneer dié getalle oorskry word.

Risikotydperk vir beskadiging	Gemiddelde besmetting in een week		Gemiddelde besmetting in twee weke	
	Vrugte met larwes (%)	Vrugte met volwassenes of larwes (%)	Vrugte met larwes (%)	Vrugte met volwassenes of larwes (%)
BBV - 4 weke	2	4	1	2
5 - 6 weke	3	6	2	4
7 - 8 weke	4	8	3	6
9 - 10 weke	5	10	4	8
11 - 12 weke	6	12	5	10

*Verkenners moet onder die kelkblare van elke vrug inspekteer, anders sal die besmetting onderskat word.