HLB Safe System for the production of citrus trees in nurseries

Compiled by Citrus Research International and HLB Steering Committee

Version 1.3: March 2023

Content layout

Appendices

A. BACKGROUND

Huanglongbing (HLB), or Asian Citrus Greening, is a bacterial disease associated with *Candidatus* Liberibacter asiaticus and is mostly spread by the insect vector Asian Citrus Psyllid (ACP), *Diaphorina citri*. African Citrus Greening, caused by *Candidatus* 'Liberibacter africanus' and vectored by the African Citrus Triozid (ACT), *Trioza erytreae*, is endemic in certain parts of South Africa and other African countries. For clarity, this document with refer to Huanglongbing (Asian Citrus Greening) as 'HLB', and African Citrus Greening as 'Greening'. Given heat sensitivity of the bacterium and vector, Greening is not as severe a disease as HLB.

HLB is the most devastating disease of citrus worldwide and presently does not occur in southern Africa. However, ACP was detected and is spreading in central-east Africa, and HLB occurs in Ethiopia, Mauritius and

Reunion, and was also recently reported from Kenya. Both HLB and ACP occur in countries that are frequent trading partners with southern African countries and traders and travellers pose a threat of inadvertently spreading the disease or the vector. Additionally, ACT is endemic in Africa, and can also spread HLB.

Citrus industry representatives and governments in South Africa and elsewhere developed contingency, strategic or action plans to inform the actions required for effective early detection, containment and control strategies [South Africa (Swart et al., 2012; Anon, 2020); Australia (Barkley and Beattie, 2017 draft); USA-California (CDFA, 2020); USA-Florida (USDA-APHIS, 2019)].

South Africa's HLB/ACP Action Plan was based on these international standards and best practices and concisely summarises and defines the prescribed actions following detection of HLB or ACP as standard operating procedures.

The Action Plan outlines the formation of an HLB Steering Committee (HLB-SC). The HLB-SC is a public private partnership initiative between DALRRD and the citrus industry to provide a forum for coordinating preparedness and rapid response actions to protect South Africa from the biosecurity threat posed by HLB and mitigate the impact of future incursions. The HLB/ACP Action Plan provides a framework according to which this partnership will pursue these objectives and the HLB-SC will provide the forum for oversight and decision making for implementation of the action plan. The control measures recommended in the Action Plan were promulgated in Regulation 121 of the Agricultural Pest Act: "Control Measures relating to Asian citrus psyllid (*Diaphorina citri*) and Citrus Greening: Asian and American strains (*Candidatus* Liberibacter asiaticus and *Candidatus* Liberibacter americanus)".

Briefly, the Action Plan describes the demarcation of a quarantine zone with 5-km radius around each HLB/ACP detection site. Movement of propagation material and nursery trees will be strictly prohibited from these quarantine zones, and only permitted subject to certain provisions. For citrus nurseries, these provisions include that the production nursery must be a CIS-certified nursery, and trees must be produced in compliance with the HLB Safe System, and the Declaration of Compliance.

This HLB Safe System is based on international standards (specifically the documents stated above) and describes provisions and practices specifically aimed to ensure production of citrus trees free from HLB or ACP. Prevention and management of other citrus pests and diseases in nurseries are prescribed in the Procedural Guide of the South African Citrus Improvement Scheme (CIS).

The HLB Safe System is based on world best-practice and will be updated as and when new scientific or technical information becomes available.

B. NURSERY QUALIFICATION

- Any nursery producing citrus trees may apply to participate in the HLB Safe System using the prescribed application form (appendix A). The relevant fees are appended (appendix B).
- The citrus production nursery must be a CIS-registered nursery, with infrastructure, provisions and production practices strictly according to the HLB Safe System. Importantly, the exclusive use of CIS-approved or certified propagation material for production of citrus trees is mandatory.
- The nursery will be audited using the prescribed audit form (Appendix C) and the nursery's level of compliance will be specified on a valid and signed Declaration of Compliance (Appendix D; see section H).

C. NURSERY LOCATION

Nurseries must be surrounded by an 800-m buffer zone and HLB transmission risk from any citrus tree within this 800-m zone must be mitigated through approved and recorded vector control measures and monitored through an ongoing HLB and vector monitoring programme.

The 800-m buffer zone is based on the limited daily movement of ACP [Lukasz Stelinski: Ecological Aspects of the Vector-Borne Bacterial Disease, Citrus Greening (Huanglongbing): Dispersal and Host Use by Asian Citrus Psyllid, *Diaphorina citri* Kuwayama), Insects 2019, 10, 208; doi:10.3390/insects10070208] and the biological delimiting distance necessary to achieve >95% or greater capture of new infections presumably spreading from a point infection, which was conservatively accepted by the California Department of Food and Agriculture as 400 m (TG Gottwald, personal communication). The HLB Safe System uses the 400-m buffer as minimum distance from citrus trees, and double the 400-m zone (800-m) as a vector management and monitoring zone surrounding the nursery.

The following levels of compliance are specified under the HLB Safe System, which is based on the distance of the nursery from citrus trees:

- Level 1: nursery > 800 m away from citrus trees
- Level 2: nursery > 400 m away from citrus trees, and with an 800-m vector management and monitoring zone surrounding the nursery
- Level 3: nursery > 50 m away from citrus trees, and with an 800-m vector management and monitoring zone surrounding the nursery
- Level 4: nursery without a citrus-free buffer zone, but with an 800-m vector management and monitoring zone surrounding the nursery

- The location of nurseries in HLB/ACP quarantine zones shall be inspected and the transmission risk from neighbouring plantings of HLB/ACP host species will be assessed by a compliance auditor approved by the HLB-SC.
- If transmission risk is not suitably mitigated (e.g., neglected orchards without insect pest management, or managed orchards with poor insect pest management evident from ACP trap records), compliance to the HLB Safe System will be compromised and the nursery shall be deemed non-compliant.

D. SECURITY AND ACCESS CONTROL

- No employee or visitor shall be permitted to enter the insect-secure nursery structures if they previously worked in or visited a citrus orchard or another nursery that day, and they must be dressed in clean clothing.
- Employees or visitors who have worked or visited a citrus orchard or another nursery earlier in a day, may be allowed access if clothing is covered by coveralls, or if dressed in a new set of clean clothing.
- Vehicles and other equipment shall be free from unprotected (insecticide) host plant material before entry to the nursery.

E. PHYSICAL INFRASTRUCTURE AND MAINTENANCE

All stages of citrus tree propagation must be inside insect-secure structures with the following minimum specifications:

- Greenhouse or shadehouse structures must be built from sturdy material with a solid foundation.
- Structures will be constructed to prevent HLB vector insects from entering the plant production areas.
    - Walls and roofs must be covered with materials that will prevent entry of ACP, such as polycarbonate sheets, plastic film and/or screened with insect-resistant net designed to at least exclude psyllids and triozids with the following specifications: 40-mesh or 50-mesh screen with

the shortest dimension of the mesh openings being less than/equal to 400 µm and maximum mesh size openings of 0.36 mm^2.

- It is strongly advised that structures be sub-divided with additional interior walls and doors to further preclude or minimize internal insect movement, as well as to have separate and smaller sections to minimise the implications of quarantine measures in case of a breach in one section.
- Structures must include insect-secure double entryways with positive pressure air displacement (e.g. air curtain or high-wind fans with fast start-up speeds) to prevent insects entering via the entryways.
    - For air curtains, the air speed must measure at least 1 to 3 m/s at floor level.
    - For fans, air speed must measure at least 1 to 3 m/s uniformly across the opening of the outer door.
    - Entryways with < 3m/s positive air flow must strictly be operated as double-door systems, i.e. always one door closed.
    - Entryways with higher air flow speeds (> 3m/s) can be operated as 'wind tunnels', i.e. both doors open for brief periods (< 3 min) of adequately supervised high-volume tasks (e.g. moving pots into the structure or trees out of the structure); ambient wind speeds during these periods must not exceed 3 m/s.
- Cooling pads, fans or ventilation openings must be enclosed with insect resistant screen.

- Adequate construction materials should be kept available on site if the structure is damaged so that timely repairs can be made, and staff should be suitably trained to conduct the repairs. Maintenance and repairs to structures should be recorded.
- The integrity of all insect-secure structures must be inspected and recorded by the nursery at least once a week, and twice a week for nurseries in quarantine zones.
- Any opening > 1 mm^2 (e.g. a 1 × 1 mm hole) must be regarded as a breach of insect-security and must be recorded and reported to the relevant authorities [see section G below].
    - Any breach of insect-security must be reported to the relevant authorities within 1 week of detection (for nurseries outside quarantine zones), or on the day of detection (for nurseries inside quarantine zones).
    - Any breach of insect-security must be repaired as soon as possible (on the day of detection), and a record of the repair kept for approval by an approved compliance auditor.
    - Double the density of approved ACP traps inside the structure in vicinity of any breach that cannot be repaired on the day of detection.
    - Double the density of approved ACP traps inside the structure in vicinity of moderate and major breach positions for one trapping cycle.
    - All plants in structure(s) where a breach occurred should be protected by contact and/or systemic insecticide throughout the breach period, or as soon as possible after the breach was detected.
- Nurseries must keep record of all breaches of insect-security (date, structure and location, size, probable cause, photo-record, period of breach in insect-security, vector monitoring and control records during that period, and detail of reparation and approval thereof).
- The integrity of all insect-secure structures, maintenance records and repairs will be inspected by an approved compliance auditor at least once every 6 calendar months and must meet the minimum standards; the frequency of inspection will increase to once every month for nurseries in quarantine zones.

F. NURSERY OPERATIONS

I. Sanitation

- Only CIS-certified/approved citrus plant material will be allowed into the insect-secure structures.
- All citrus nursery stock and propagative plant parts shall remain within the approved insect-secure structures at all times or moved within enclosed conveyances between structures.

II. Scouting and monitoring

- In order to demonstrate pest and disease freedom, nurseries must conduct a continuous scouting and monitoring programme (14-day cycle) using suitably trained personnel and the approved surveillance and trapping methods (yellow sticky traps, inspection and tapping of plants; see appendix to HLB/ACP Action Plan).
- Surveillance and trapping should be done in all the insect-secure structures housing citrus propagation material at a trapping density of 1 trap/1000 m^2; additional traps should also be placed inside the double-door entries to insect-secure structures.
- Pest pressure in the immediate area surrounding the HLB Safe nursery/structure must be assessed by placing 12 equally spaced ACP traps around the nursery/structure, within 30 m from the outer borders of the nursery or structure
- Nurseries must be assured of adequate insect pest (including Las vectors) control in all citrus trees in the 800-m zone surrounding the HLB Safe nursery/structure through suitable scouting and monitoring records in these isolated citrus trees and orchards, as conducted by the owner/manager of these plantings.
    - These records must be available for assessment by compliance auditors. Citrus trees within the 800-m zone without such records will be regarded as neglected plantings in risk assessments.
    - For trees in Las or ACP quarantine zones, recorded surveillance and ACP trapping must be conducted at a density of 6 ACP traps/km^2 (at least one trap per planting). Traps should ideally be placed on the perimeter of the planting facing the nursery.
- Traps inside insect-secure structures must be monitored every second week, and replaced every second month. Traps placed outside insect-secure structures must be monitored and replaced at least every month. The collected traps must be sent to the trap reading service at CRI Citrus Research Centre in Nelspruit for microscopic evaluation. All trapped ACP and ACT specimens will be subjected to Las PCR diagnostics. Data will be recorded on the official ACP trapping database.
- Nurseries must ensure that staff members involved in pest scouting are adequately trained in the approved surveillance and trapping methods and identification of citrus pests and diseases, particularly HLB symptoms, and signs and symptoms of ACP, as well as *Trioza erytreae*, the triozid vector of African Greening, which can also vector HLB.
- Nurseries shall keep accurate records of scouting and insect monitoring in all HLB Safe structures and citrus plantings in the 800-m zone surrounding the nursery, as well as records of the relevant staff training.
- Scouting and monitoring practices and records will be audited once every 6 months, when an official survey will also be conducted in all structures, which may include the areas surrounding the nursery and neighbouring citrus plantings (if applicable); the frequency of audit surveys will increase to once every month for nurseries in quarantine zones.
- The HLB-SC may amend the scouting and monitoring protocols based on specific circumstances.

III. Production practices

- Apart from those prescribed in the HLB Safe System, nursery production practices prescribed by the CIS Procedural Guide must be followed.

- Under the HLB Safe System, production of citrus trees from non-certified material will be strictly forbidden.
- All production practices, people and vehicle movement in and out of structures should be conducted in such a manner that the insect-security of the structures is not compromised. Instances of breached insect-security must be recorded and reported to the approved compliance auditor within 1 week of detection.

IV. Vector control programme (applicable to nurseries in quarantine zones)

- For nurseries in quarantine zones, a preventative HLB vector control programme must be followed to provide continuous protection using registered systemic and contact insecticides.
- Nursery trees must be protected with a registered systemic insecticide, which was applied within 2 weeks prior to despatch.
- Nursery trees must be thoroughly sprayed with a contact insecticide within 3 days of despatch, but after final topping in preparation for despatch.

V. Loading and movement protocol (applicable to nurseries in quarantine zones)

- The provisions for Security and Access Control should be strictly followed.
- Trees to be moved must be topped and thereafter treated with a contact insecticide within 3 days of loading and must be free from any flush growth at the time of loading.
- Transport must be in a truck of which the loading bin is enclosed to prevent entry of insect vectors.
- Citrus trees or propagation material may only be moved from quarantine zones if accompanied by a valid and official permit verifying that all conditions of the HLB Safe System and any additional qualifications stipulated in the compliance agreement have been met.
- Inspection, treatment, shipment and certification records from the nursery must be maintained for at least 3 years and be available to the approved compliance auditor or DALRRD upon request.

G. BREACH OF INSECT-SECURITY AND RISK ASSESSMENT

- A breach of insect-security can be defined as any physical opening larger than 1 mm^2 providing a potential direct passage for an adult HLB insect vector into the insect-secure structure; a breach can also include operational or procedural actions leading to compromised insect-security, such as movement of non-certified material into the structure, or people entering the insect-secure structure after visiting an orchard or non-HLB Safe nursery.
- On a weekly basis, nurseries must inspect all insect-secure structures and record all breaches of the prescribed physical and operational measures ensuring insect-security of the structures. Nurseries must self-assess the risk of each breach using the Risk Assessment Matrix in Appendix E.
- The Risk Assessment Matrix in Appendix E is used as a guideline, and considers the nursery's level of compliance to the HLB Safe System, the size of the host-free buffer zone, the size and duration of the breach, insect vector pressure in and around the nursery, as well as whether the nursery is situated in a Las and/or ACP quarantine zone and the specific incursion scenario (if applicable).
- Nurseries outside quarantine zones
    - Nurseries outside quarantine zones must submit a report of breaches and risk assessments to the approved compliance auditor on a 3-monthly basis; however, all breaches self-assessed as ORANGE or RED must be submitted within one week of detection.
    - The compliance auditor will provide feedback on the accuracy of risk assessments conducted by nurseries outside quarantine zones, as well as guidance on future breach reporting, risk mitigation and assessment.
- Nurseries in quarantine zones

- Nurseries in quarantine zones must submit reports of breaches and risk assessments on a weekly basis.
- Breach and risk assessment reports from nurseries in quarantine zones will be validated by at least two approved compliance auditors within 7 days of receipt.
- GREEN cases
    - Breaches that were assessed and validated as 'acceptable level of risk' (GREEN) will be reported to the nursery and the HLB-SC's Risk Assessment sub-committee.
    - Compliance auditors are obliged to take a conservative and cautious approach, and cases assessed as GREEN by the nursery might have to be reviewed by a panel of at least three approved compliance auditors, and referred to the HLB-SC's Risk Assessment sub-committee if re-assessed as ORANGE or RED.
- ORANGE or RED cases
    - Breaches assessed as a case of non-compliance (ORANGE or RED) by the nursery will be validated by a panel of at least two approved compliance auditors.
    - ORANGE or RED cases reviewed by the compliance auditors and re-assessed GREEN will be reported to the nursery and the HLB-SC's Risk Assessment sub-committee within 7 days of the initial report.
    - Validated cases of non-compliance (ORANGE or RED) will be submitted to the HLB-SC's Risk Assessment sub-committee to consider whether to uphold or amend the reported assessment and/or to propose suitable mitigation measures. This final assessment will be reported to the nursery and the HLB-SC within 14 days of receiving the report from the compliance auditors.
    - Movement of propagation material from nursery structures that are non-compliant to the HLB Safe System may remain prohibited until an appropriate risk assessment was conducted and risk mitigation steps implemented and officially approved.
- Failure to report a breach of insect-security may result in the nursery's disqualification from the HLB Safe System.

H. COMPLIANCE AUDITS AND ASSESSMENT

I. Responsibility of participating nurseries

- Nurseries must complete an application form to participate in the HLB Safe System. Nurseries will subsequently be inspected to determine compliance and the level of compliance.
- Nurseries must be familiar with all provisions of the CIS Procedural Guide, Regulation 110 of the Agricultural Pest Act, the official and most recent versions of the HLB/ACP Action Plan and the HLB Safe System, in particular all provisions and procedures within the nursery's control and responsibility.
- Nurseries must ensure that all employees are suitably trained to comply with all the provisions and procedures of the HLB Safe System using the officially approved methods.
- Nurseries must conduct internal compliance audits on a monthly basis to identify risks to compliance and to identify areas that require improvement.
- Nurseries must conduct weekly inspections of the integrity of insect-secure structures.
- Nurseries must record all breaches of the prescribed physical and operational measures ensuring insect-security of the structures and must self-assess the risk using the Risk Assessment Matrix in Appendix E on a weekly basis.
- Any breach of insect-security must be repaired/corrected as soon as possible, and a record of the repair/correction kept for approval by an approved compliance auditor.
- Nurseries in quarantine zones are prohibited from moving propagation material, and may do so only from insect secure structures that are compliant to the HLB Safe System when specifically authorised by means of an official movement permitted as contemplated in the HLB/ACP Action Plan.

II. Responsibility of the approved compliance auditor

- A list of compliance auditors approved by the HLB-SC is appended (Appendix F).
- Receive and consider nursery applications and conduct induction inspections and audits within 1 month at nurseries with valid applications.
- The approved compliance auditor will inspect and audit the nursery once every 6 months, or once every month for nurseries in quarantine zones, using the approved inspection methods and audit form (see appendix C).
- Results from audits and inspections will be reported to the nursery following the audit/inspection. A written report will be submitted to the nursery as well as the HLB-SC within 1 month after audit/inspection.
- The approved compliance auditor will receive breach and risk assessment reports from nurseries for assessment, validation and/or submission to the HLB-SC as contemplated in Section G, and report to nurseries within the prescribed time periods.
- An up-to-date compliance record will be kept for each nursery to be used for audit and risk assessment purposes
- The approved compliance auditor will also act in a technical advisory capacity, supporting nurseries to comply with the HLB Safe System.

III. Declaration of Compliance

- If the nursery meets the minimum standards of the HLB Safe System, the nursery's legally responsible person (owner / manager) will be required to sign a Declaration of Compliance (see appendix D), in which the nursery's responsibilities and level of compliance will be stipulated and agreed to by the nursery. The Declaration of Compliance will be valid for 6 months, and 1 month for nurseries in HLB or ACP quarantine zones, and will only be renewed after an official inspection and audit, as described above.

- The legally responsible person for a nursery participating in the HLB Safe System must sign a declaration of compliance stating the following:
    - Declaring the person's awareness of the relevant legislation pertaining to the movement of Citrus plant material and execution of the HLB/ACP Action Plan in SA, including the requirements of the HLB Safe System.
    - Declaring the nursery's sustained compliance with the procedural, operational and infrastructural requirements of the HLB Safe System, which includes the required monitoring and reporting of any breach of insect security.
    - The nursery's level of compliance will be specified on a valid and signed Declaration of Compliance, stating that the nursery complies with all the requirements of the HLB Safe System. The following levels of compliance are specified under the HLB Safe System:
        - Level 1: nursery > 800 m away from citrus trees
        - Level 2: nursery > 400 m away from citrus trees, and with an 800-m vector management and monitoring zone surrounding the nursery
        - Level 3: nursery > 50 m away from citrus trees, and with an 800-m vector management and monitoring zone surrounding the nursery
        - Level 4: nursery without a citrus-free buffer zone, but with an 800-m vector management and monitoring zone surrounding the nursery

IV. Non-compliance and re-instatement of compliance

- It is the nursery's responsibility to inform the relevant officials in writing of any breach of insect-security within 1 week of detection. When a breach is assessed as a case of non-compliance to the HLB Safe System, movement of trees or propagation material from these nurseries, or specific nursery structures, *in quarantine zones* may be prohibited until a further risk assessment is conducted and risk mitigation steps implemented and officially approved as set out in Section G.
- Subsequent to implementation of the recommended risk mitigation steps, the nursery can request a re-audit (e.g. in cases where a nursery lost its HLB Safe status completely), or wait for the next audit (e.g. in cases where only certain structures were declared non-compliant).
- Re-instatement of compliance will be considered by a panel of at least three approved compliance auditors, and the outcome reported to the nursery within 7 days of the audit.
- Re-instatement of compliance for nurseries *in quarantine zones* will be considered by a panel of at least three approved compliance auditors, and the outcome reported within 7 days of the audit to the HLB-SC's Risk Assessment sub-committee for a final assessment; such assessment will be reported to the nursery within a further 14 days.

V. Responsibility of DALRRD

- Participate on the HLB-SC and the HLB-SC's Risk Assessment sub-committee
- Authorisation of compliance auditors and regular assessment of HLB Safe System auditing procedures
- Administration of permitted movement from quarantine zones, including issuance and withdrawal of permits, inspection of loading and movement protocols as set out in section F and the HLB/ACP Action Plan.
- Present all applications for citrus propagation material movement permits from nurseries in a quarantine zone to the HLB-SC's Risk Assessment sub-committee, which must consider the nursery's Declaration of Compliance to the HLB Safe System, the nursery's level of compliance, as well as the history of breaches and cases of non-compliance recorded for each nursery before issuance of a movement permit, with permit conditions based on the recommendations of the HLB-SC's Risk Assessment sub-committee.

- Administer the withdrawal of any movement permit as recommended by the HLB-SC's Risk Assessment sub-committee

I. DISPUTE RESOLUTION

Three levels of potential disputes are recognised in execution and audit of HLB Safe System: these are disputes arising from audit results, outcomes of risk assessments for breached insect security, and risk measure disputes, such as interpretation of risk or mitigation measures in issuance (or not) of movement permits. Formalisation of any complaint or dispute may and should be preceded by engagement between senior executive managers of the two parties, assisted by such technical experts as the parties may deem necessary. The parties would in the normal course of business seek to find amicable agreement on either resolution or a process to follow to achieve resolution within the means prescribed by the relevant legislation. If the executive management engagement is unable to resolve the dispute, they would invariably agree to dispute resolution process forward. Formal disputes will first be presented to the HLB-SC for resolution, who will endeavour to rule on the dispute within 14 days. Disputes that cannot be resolved at the HLB-SC level will be subject to the dispute resolution measures set out in the Agricultural Pest Act.

Appendix A

HLB Safe System for the production of citrus trees: nursery application form

According to the HLB/ACP Action Plan and related Regulations, movement of plants and plant products (excluding seed and fruit without leaves) of HLB or ACP host species (Citrus and related species, Murraya and/or Choisya) will be prohibited from areas within 5 km from HLB or ACP detection points. Movement of Citrus plants and plant products from these quarantine zones to pest-free zones can only be permitted from nurseries in compliance with the HLB Safe System for production of citrus trees. Application for participation in the HLB Safe System can be done on this form. Approval and level of compliance will be subject to audit inspections and relevant fees as specified in the most recent version of the 'HLB Safe System for the production of citrus trees'.

Nursery name		**Legally Responsible Person (owner/manager)**	
District/Province		Address	
Telephone		Telephone	
Email		Email	
CIS registration number		**CIS-certification (Yes / No)**	

Nursery type (Citrus/Retail)	**Nursery products (indicate annual supply volume)**	
	Trees / plants	Budwood

Nursery location (GPS coordinates)	
Nursery layout	

Insert Google Maps image showing nursery layout, indicating all structures in which citrus or relevant HLB or ACP host species are produced

Citrus plantings in 800-m buffer zone ***Indicate size of citrus-free buffer zone below***							
800-m		**400-m**		**50-m**		**None**	

Insert Google Maps image showing nursery and 800-m perimeter surrounding the nursery. All citrus plantings in 800-m buffer zone must be indicated and named/numbered.

Contact details of land owners in the 800-m buffer zone with citrus plantings					
Name / number	Orchard / Planting details	Owner	Farm/Address	Telephone	Email

Queries and/or completed forms can be submitted to cis@cri.co.za

Appendix B: **APPLICABLE FEES**

Service / task	Service provider	Fee*	Fee payable by
Routine audits (programme)	CRI	R 3064.70	Nursery
Ad hoc audits / inspections	CRI	Actual costs	Nursery
Trap reading service	CRI	POA	Nursery
Routine PCR diagnostics (surveillance)	CRI	POA	CRI - Biosecurity
PCR diagnostics (quarantine zones)	CRI, DALRRD, ARC	POA	CRI - Biosecurity
Movement permit	DALRRD	POA	Nursery

*POA: price on application from service provider

Appendix C

HLB Safe System: Nursery audit form	**Date:**

Nursery name		**Legally Responsible Person (owner/manager)**	
District/Province		Address	
Telephone		Telephone	
Email		Email	
CIS registration number		**CIS-certification (Yes / No)**	

NURSERY LOCATION and BUFFER ZONE					
Buffer zone surrounding nursery (800m, 400m, 50m, <50m)		African Greening area (Y/N)		Citrus Black Spot area (Y/N)	
Citrus in 800-m buffer zone (Y/N)		Owner contacts on record (Y/N)		Proof of HLB vector monitoring and control on record (Y/N)	
SECURITY AND ACCESS CONTROL (Y/N; specify)					
Nursery fenced and locked		Access control (workers)			
Access control (visitors)		Access control (vehicles)			
PHYSICAL INFRASTRUCTURE AND MAINTENANCE (Y/N)					
All stages of plant propagation in insect-secure structures		Double-door entryways insect-secure with air-curtain			
Records indicate weekly inspection of structures		All insect-security breaches recorded		All breaches fixed and reported	
Breaches ruled as non-compliance since last audit (name structures)					

Audit inspection report:
(list all nursery structures, status of HLB Safe compliance; report breaches of insect-security not previously reported; general feedback)

NURSERY OPERATIONS				
Sanitation: no non-certified propagation material propagated in the nursery (Y/N; if N, indicate which structures)				
Scouting and monitoring of HLB vectors				
Struc-tures	Scouting program (every X weeks)		Staff suitably trained (Y/N)	
	Trapping program (replace traps every X weeks)		Trapping density (traps/1000m²)	
800-m zone	Scouting program (every X weeks)		Insect control adequate (Y/N)	
	Trapping program (replace traps every X weeks)		Trapping density (traps/km²)	
Record keeping up to date (Y/N; if N, specify non-compliance)				

Audit inspection report (nursery):
(list structures; report observations insect incidence and trap placement; report on results of trapping/monitoring; control measures)

Audit inspection report (800-m zone):
(list citrus plantings; report observations insect incidence and trap placement; report results of trapping/monitoring; control measures)

Production practices compliance with CIS Certification criteria (Y/N; if No, specify non-compliance)	
Vector control program* plants continuously protected by insecticide (Y/N; if No, specify non-compliance)	
Loading and movement* HLB Safe compliant protocol in place (Y/N; if No, specify non-compliance)	

*Only for nurseries in quarantine zones

AUDIT RESULT					
HLB Safe compliant (Y/N/Q*)		**Level of compliance** [Level 1, 2, 3 or 4]		**Next audit or re-audit date**	
***Qualified audit** (specify qualification; list structures)					
Compliance auditor 1	Name: Signature:		**Nursery representative**	Name: Signature:	
Compliance auditor 2	Name: Signature:		**Date**		

Appendix D

HLB Safe System: Nursery Declaration of Compliance

Nursery name		Legally Responsible Person (owner/manager)	
District/Province		Address	
Telephone		Telephone	
Email		Email	
CIS registration number		**CIS-certification (Yes / No)**	

Nursery's level of compliance to the HLB Safe System (mark with X)			
Level 1 (800 m)*	**Level 2** (400 m)	**Level 3** (50 m)**	**Level 4** (no buffer zone)
*Size of citrus-free buffer zone **Within an 800-m vector-free treatment and monitoring zone			

Compliance valid for		**month(s)*** **from**		**to**	
*Insert applicable duration: 6 months as default and 1 month for nurseries in HLB or ACP quarantine zones					

As duly assigned Legally Responsible Person of the nursery, I declare the following:

1. I am familiar with the HLB/ACP Action Plan of South Africa, the Agricultural Pests Act of 1983 and relevant regulations, *viz.* R.110 and R.44.1.88, respectively pertaining to the movement of Citrus plant material and execution of the HLB/ACP Action Plan.
2. Accordingly, I am aware that movement of plants and plant products (excluding fruit without leaves and seed) of HLB or ACP host species (Citrus and related species, *Murraya* and *Choisya* spp.) will be prohibited from declared HLB or ACP quarantine zones, and that movement of plants and plant products from these areas to pest-free areas can only be permitted from nurseries in compliance with the HLB Safe System for production of the relevant host species. Permitted movement may be restricted by R.110 and will be dependent on the specific incursion scenario and the nursery's level of compliance with the provisions of the HLB/ACP Action Plan and HLB Safe System. Movement will be subject to inspection and issuance of the relevant permit by a DALRRD inspector and must meet the requirements of the HLB/ACP Action Plan.
3. I am aware that compliance to the HLB Safe System will be audited once every 6 months, or monthly for nurseries in HLB or ACP quarantine zones. The nursery's level of compliance will be assessed, and will also be based on the size of the citrus-free buffer zone surrounding the nursery.
4. I hereby declare the nursery's sustained compliance to the procedural, operational and infrastructural requirements of the HLB Safe System, including the required monitoring and reporting of any breach of insect security.

Signed _____ on _____ at _____

Compliance auditor 1: _____ Signature: _____

Compliance auditor 2: _____ Signature: _____

Appendix E: Risk assessment matrix

Reports of procedural, operational and/or structural breaches of insect-security will be assessed by nurseries on a weekly basis. This risk assessment matrix must be used as guidance. A detailed description and photos of breach, including the reparation thereof, must be appended to the completed and signed risk assessment matrix. For nurseries in quarantine zones, the risk assessments will be validated by the approved compliance auditor and the HLB-SC's Risk Assessment sub-committee to determine whether the breach constitutes a case of non-compliance to the HLB Safe System.

Nurseries must assess the extent of the breach (minor, moderate, major or RED), as well as the risk indicators (insects trapped inside structures, vectors trapped in the buffer zone and vector control measures in place) in the relevant column, based on the nursery's level of compliance and the Las/ACP incursion scenario. The 0, 1, 2, 3 or 5 scores for each of the aforementioned assessments are totalled to get a 'breach score' and a 'risk score'. The final result, i.e. the sum of the 'breach score' and 'risk score', is used as an overall indicator of the risk: a final score of 1-3 indicates acceptable risk (GREEN), 4 indicates an ORANGE risk alert, and a score of ≥ 5 is a RED risk alert, which is regarded as a case on non-compliance to the HLB Safe System. **Non-permitted movement of propagation material from nursery structures in HLB/ACP quarantine zones that are non-compliant to the HLB Safe System is strictly forbidden.**

Breach reports and risk assessments of nurseries outside quarantine zones must be reported to the compliance auditor on a 3-monthly basis for validation and recording; however, all breaches self-assessed as ORANGE or RED must be submitted within one week of detection. Nurseries in quarantine zones must submit breach report and risk assessments to the compliance auditor for validation on a weekly basis; all validated RED assessments will be submitted to the HLB-SC's Risk Assessment sub-committee for endorsement.

RISK ASSESSMENT EXPLANATORY NOTES

Nursery's level of compliance to the HLB Safe System

- **Level 1**: nursery > 800 m away from citrus trees (800 m buffer zone)
- **Level 2**: nursery > 400 m away from citrus plantings, and with an 800-m vector management and monitoring zone surrounding the nursery (400 m buffer zone)
- **Level 3**: nursery > 50 m away from citrus plantings, and with an 800-m vector management and monitoring zone surrounding the nursery (50 m buffer zone)
- **Level 4**: nursery without a buffer zone, but with an 800-m vector management and monitoring zone surrounding the nursery

Incursion scenario

- **Scenario 0**: no Q-zone
- **Scenario A**: A-1: ACP point incursion (5-km quarantine zone) and A-2: ACP range expansion (area quarantined comprises the magisterial district, or magisterial districts in the broader citrus production region in which ACP or Las was detected)
- **Scenario B**: B-1: Las point incursion but no vector activity (400-m quarantine zone) and B-2: Las point incursion, ACT present and active, but ACP absent (5-km quarantine zone)
- **Scenario C**: B-3: Las point incursion, ACP present and active (5-km quarantine zone) and B-4: Las + ACP range expansion (area quarantined comprise the magisterial district, or magisterial districts in the broader citrus production region in which ACP or Las was detected)

Breach description

- **Structural breach** [to be conducted for each separate structure; cumulate size of hole(s)]
  - **None** (no holes > 1 mm^2 detected)
  - **Minor**
    - Hole(s) with a cumulative length of tear of 1 to 150 mm

- **Moderate**
  - Hole(s) with a cumulative length of tear of > 150 mm and < 1 meter
- **Major**
  - Hole(s) with a cumulative length of tear of > 1 meter
- **RED**
  - Any major structural breach that is not fixed within 1 week of detection

- **Procedural breach** [to be conducted for each separate structure; cumulate breaches]
  - **None** (no breach)
  - **Minor**
    - Entryway air curtain/fan not working adequately (air movement at outer door < 1 m/s), but entryways insect-secure and strictly operated as double-door system, i.e. always one door closed.
    - Double-door entryway operated as 'wind tunnel', but not meeting one of the requirements, i.e. both doors may be open for brief periods of time (< 3 min); operations must be adequately supervised; air curtain/fan must work adequately (air movement at outer door > 3 m/s); and ambient wind speeds during these periods must not exceed 3 m/s.
  - **Moderate**
    - Double-door entryway operated as 'wind tunnel', but not meeting two of the requirements, as stated above.
  - **Major**
    - Double-door entryway operated as 'wind tunnel', but not meeting two of the requirements, as stated above.
  - **RED**
    - Use of non-certified or –approved propagation material in nursery structure
    - Movement of propagation material from a non-HLB Safe structure into an HLB Safe structure
    - Person entering a nursery structure on the same day after visiting an orchard or nursery in an HLB quarantine zone, without taking measures to prevent spread of the insect vector on his/her person (i.e. clean clothes)

Risk indicators

- **Citrus pests trapped inside structures**
  - **Negligible risk** (no citrus pests trapped/monitored inside structures)
  - **Minor**
    - Citrus pests (but no HLB vectors) occasionally (<1 out of 3 trapping cycles) trapped/monitored
  - **Moderate**
    - Citrus pests (but no HLB vectors) regularly (1-2 out of 3 trapping cycles) trapped/monitored
  - **High**
    - Citrus pests (but no HLB vectors) constantly (>2 out of 3 trapping cycles) trapped/monitored
  - **RED**
    - ACP trapped/monitored inside structure
    - HLB vectors (ACP/ACT) trapped inside structure of nursery in HLB quarantine zone
- **Insects trapped outside structures**
  - **Negligible risk**
    - No HLB vectors trapped/detected
  - **Minor**
    - Low numbers (<0.1 per trap/month) of HLB vectors occasionally (<1 out of 3 trapping cycles) trapped/detected
  - **Moderate**
    - Moderate numbers (0.1-0.2 per trap/month), or low numbers (<0.1 per trap/month) of HLB vectors regularly (1-2 out of 3 trapping cycles) trapped/detected

- **High**
  - High numbers (>0.2 per trap/month), or HLB vectors constantly (>2 out of 3 trapping cycles) trapped/detected
- **RED**
  - HLB vectors regularly trapped/detected, and general insect pest levels indicating poor control in buffer zone, or citrus planting(s) in buffer zone is neglected

- **Vector control**
  - **Minor**
    - All plants in implicated structure(s) protected prior to and throughout breach by contact and/or systemic insecticide
  - **High**
    - Plants in implicated structure(s) not insecticide protected during the breach period

HLB Safe System: Risk assessment for Insect-Security Breaches

Nursery name		Legally Responsible Person	
Address		Email	

DESCRIPTION OF BREACH IN INSECT-SECURITY OF HLB SAFE NURSERY STRUCTURES

(COMPLETE FOR EACH SEPARATE STRUCTURE: name structure; describe date, position, size and duration and/or circumstances of breach; attach photos)

Structure:	Date detected:

Description of breach:

Risk assessment** (for each measure of breach/risk, mark with **X** for the specific incursion scenario)		HLB Safe Nursery's level of compliance															
		Level 1 (800-m buffer)				Level 2 (400-m buffer)				Level 3 (50-m buffer)				Level 4 (no buffer)			
		0	A	B	C	0	A	B	C	0	A	B	C	0	A	B	C
ASSESSMENT OF STRUCTURAL OR PROCEDURAL INSECT SECURITY BREACH																	
Structural breach	None	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Minor	0	0	1	1	0	0	1	1	0	1	2	2	0	1	2	2
	Moderate	0	1	2	3	0	1	2	3	1	2	3	3	1	2	3	3
	Major	1	2	3	3	1	2	3	3	2	2	3	3	2	2	3	3
	RED	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Procedural breach	None	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Minor	0	0	1	1	0	0	1	1	0	1	2	2	0	1	2	2
	Moderate	0	1	2	3	0	1	2	3	1	2	3	3	1	2	3	3
	Major	1	2	3	3	1	2	3	3	2	2	3	3	2	2	3	3
	RED	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
BREACH SCORE (sum of scores)																	
ASSESSMENT OF RISK INDICATORS																	

Citrus pests trapped in structure	**Negligible**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Minor	0	0	0	1	0	0	0	1	0	1	2	2	0	1	2	2
	Moderate	0	1	1	2	0	1	1	2	1	2	3	3	1	2	3	3
	High	1	2	3	3	1	2	3	3	2	2	3	3	2	2	3	3
	RED	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Vectors trapped outside structure	**Negligible**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Minor	0	0	1	2	0	1	1	2	0	1	2	2	0	1	2	2
	Moderate	1	1	2	2	1	2	2	2	1	2	3	3	1	2	3	3
	High	2	2	3	3	2	2	3	3	2	2	3	3	2	2	3	3
	RED	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Vector control	**Minor risk**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	High	1	2	2	2	1	2	2	2	1	2	2	2	1	2	2	2
RISK SCORE (sum of scores)																	
FINAL RESULT Breach score + Risk score: 1-3 = GREEN 4 = ORANGE ≥ 5 = RED risk alert																	

Nursery's Risk Assessor **Name and signature:** **Date:**	**Nursery's legally responsible person** **Signature:** **Date:**

COMPLIANCE AUDITOR'S VALIDATION REPORT

(Conclusion, recommendations, endorsements required for validated RED assessments)

Assessor 1: **Date:**	**Assessor 2:** **Date:**	**Assessor 3:** **Date:**	**Refer for HLB-SC endorsement (Y/N)**	

Appendix F: **List of approved compliance auditors**

SURNAME, Name	Company	Highest qualification	Mobile number	Email address
FOURIE, Paul	CRI	PhD(Agric) (Plant Pathology)	083 290 2048	phf@cri.co.za
MEYER, Jacolene	CRI	MSc (Microbiology, Virology)	082 213 2432	jacolene@cri.co.za
MOMMSEN, Wayne	CRI	Hons.BSc. (Chemistry)	083 321 9091	mommsenw@cri.co.za
NELL, Michael	CRI	B.Agric (Agronomy)	073 750 9659	michael@cri.co.za
PRETORIUS, MC	CRI	MSc.Agric (Plant Pathology)	082 338 9853	mc@cri.co.za

Appendix G: GUIDELINES FOR TRAPPING AND SCOUTING FOR HLB VECTORS

Introduction

Huanglongbing (HLB) is a bacterial disease of citrus that can be transmitted by two insect (psyllid) vectors: Asian Citrus Psyllid (ACP), *Diaphorina* citri (Fig. 1) and African Citrus Triozid (ACT), *Trioza erytreae* (Fig. 2).

To determine the presence/absence and prevalence of HLB vectors (1) inside HLB Safe structures, (2) in the area immediately outside of the nursery structures, and (3) in citrus orchards in the 800-m vector management and monitoring zone surrounding the nursery, regular inspection in- and outside of the structures by trapping and scouting is required. Trapping entails the use of double-sided yellow sticky traps to determine the presence of adult psyllids. Scouting entails a visual examination of new tender flush shoots on a tree to determine the presence of psyllids, usually eggs and/or nymphs.

This document describes the scouting and trapping procedures that should be followed inside and outside of HLB Safe structures. These procedures should be implemented by suitably trained personnel (see below). Records of training, scouting and trapping procedures as well as data collected should be kept for audits.

(A) Trapping and scouting inside HLB Safe structures
(*double the prescribed trap density, monitoring frequency, as well as scouting frequency and intensity for nurseries in Las/ACP quarantine zones*)

- **Insect trapping**
  - **Trap density and placement**
    - 1 trap per 1000 m^2
    - Traps should be equally distributed inside the structure and affixed to greenhouse structure at a height of ≈2 m. Traps should be suspended at the same location each time.
    - Additional traps should also be placed inside the double-door entries to insect-secure structures
    - Label each trap according to the nursery, structure number, trap number and date of trap placement.
    - A map showing the trap positions should be drawn and kept on record.
  - **Trap monitoring**
    - Traps should be inspected once every 2 weeks for presence of HLB vector adults with the aid of a magnifying glass with minimum 2.5× magnification.
    - Record trapping data as follows: nursery name, structure number, trap number, date of trap placement, date of trap inspection and number of adult HLB vector and/or suspect HLB vectors.
    - In case of detection of a suspect HLB vector adult, the trap containing the suspect specimens should be immediately removed and replaced with a new trap. The removed trap should be sent to CRI-CRC's Diagnostic Centre for trap reading, as explained below.
  - **Trap replacement**
    - Traps should routinely be replaced once every 2 months; reduce this interval if traps are excessively covered in dirt and other insects, or if the traps are not sticky enough by the end of the period (the CRI-CRC's Diagnostic Centre will also provide feedback in this regard).
    - Following trap removal, the date of trap removal should be recorded on the trap. The trap should be covered with a plastic cling film. Creases should be avoided on

the plastic film by placing the trap on a flat surface before covering it. Care should be taken not to damage the insect specimens on the trap while covering.

- Traps should be couriered immediately to the CRI-CRC's Diagnostic Centre in Nelspruit (Elaine Basson, CRI Diagnostic Centre, 2 Baker Street, Nelspruit 1200, Tel. 013-7598000) for trap reading, identification of suspect HLB vectors, and PCR-analysis for Liberibacter species. If immediate shipment is not possible, the traps should be kept in a fridge (5°C) until sent.

- **Insect scouting**
  - **Scouting programme**
    - Once every 2 weeks
  - **Scouting method**
    - Flush shoots should be targeted for inspection. A flush shoot consists of newly formed leaves which are either feather-like or tender (yellow-green in colour and supple).
    - In each insect-secure structure, randomly select 5 rows. For structures with more than 2500 trees, divide them into sections of 2500 trees and select 5 rows in each section. Out of the 5 rows selected, at least two should be in the borders of the structure or section. In sections near an entrance, one of the border rows should face the entrance.
    - In each row, randomly select at least 20 trees (data trees) with flush shoots. Use a magnifying glass (minimum 2.5× magnification) to scout for adults, eggs and immature stages (e.g., nymphs) on the leaves of one randomly selected flush shoot per selected tree.
    - For each nursery, structure number/section number within nursery, row number and data tree, record scouting data for HLB vector adult, immature stages and/or eggs as follows: for incidence, record 0 when none was found and 1 for a positive detection. Precise counts of the HLB vector are not required to indicate the prevalence; use 'low' (<10 individuals), 'medium' (10-30 individuals) or 'high' (>30 individuals). Likewise, damage by vectors should be recorded (e.g. Trioza pockmarks), even if no live vectors are seen. Templates for suggested trapping and scouting record forms are available from CRI.
    - In case of detection of the HLB vector on a flush shoot, the flush shoot should be picked, placed in a zip lock bag and couriered immediately to the CRI-CRC's Diagnostic Centre in Nelspruit (Elaine Basson, CRI Diagnostic Centre, 2 Baker Street, Nelspruit 1200, Tel. 013-7598000) for confirmation of the HLB vector species and PCR-analysis for Liberibacter species. If immediate shipment is not possible, the samples should be kept in a fridge at 5°C until sent.

(B) Insect trapping in immediate area surrounding HLB Safe structures (within 30 m from nursery border) (*double the prescribed trap density, monitoring frequency nurseries in Las/ACP quarantine zones*)

- **Trap density and placement**
  - 12 traps placed at equal distances from each other on the nursery perimeter
  - Traps can be affixed to the greenhouse structure, trees or poles at a height of ≈2 m. Traps should be suspended at the same location each time.
  - Label each trap according to the nursery, perimeter trap number and date of trap placement.
  - A map showing the trap positions should be drawn and kept on record.

- **Trap monitoring**
  - Traps should be inspected once every 2 weeks for presence of HLB vector adults with the aid of a magnifying glass (minimum 2.5× magnification)
  - Record trapping data as follows: nursery name, perimeter trap number, date of trap placement, date of trap inspection and number of adult HLB vector and/or suspect HLB vectors.
  - In case of detection of a suspect HLB vector adult, the trap containing the suspect specimens should be immediately removed and replaced with a new trap. The removed trap should be sent to CRI-CRC's Diagnostic Centre for trap reading, as explained below.
- **Trap replacement**
  - Traps should routinely be replaced at least once every 2 months, as explained above
  - Following trap removal, the date of trap removal should be recorded on the trap. The trap should be covered with a plastic cling film. Creases should be avoided on the plastic film by placing the trap on a flat surface before covering it.
  - Traps should be couriered immediately to the CRI-CRC's Diagnostic Centre in Nelspruit (Elaine Basson, CRI Diagnostic Centre, 2 Baker Street, Nelspruit 1200, Tel. 013-7598000) for trap reading, identification of suspect HLB vectors, and PCR-analysis for Liberibacter species.

(C) Citrus trees within the 800-m vector management and monitoring zone surrounding the nursery

Nurseries must be assured of adequate insect pest (including Las vectors) control in all citrus trees in the 800-m zone surrounding the HLB Safe nursery/structure. This must be confirmed by monitoring and access to suitable trapping and scouting records. Whilst the trapping and scouting can be conducted by the owner/manager of these plantings, the nursery remains responsible, and must also ensure that monitoring methods follow the prescribed guidelines:

- Commercial orchards:
  - Traps should be placed on citrus trees along orchard edges at a density of 6 per 100 ha. Place 1 trap for orchards of 20 ha or lower.
  - One trap should be placed on the outside canopy of a citrus tree and preferably on either the southern or eastern side of the tree, about 1.5-2m above ground.
  - Label each trap according to the orchard name, trap number and date of trap placement.
  - For scouting, consult CRI's Production Guidelines on orchard inspection for detailed procedures. In brief, select 10 permanent data trees per ha; select 5 permanent data trees for orchards of less than 1 ha. Trees can be selected in a diagonal transect with the first and last trees on the outer corners of the orchard. In larger orchards, trees can be either in a V- or W-shaped transect. The permanent data trees should be clearly marked. At least 10 flush shoots should be checked per tree when present. Scouting should be conducted at least once every 2 weeks.
- Citrus trees in non-commercial settings
  - Traps should be placed as described above on citrus trees at a density of 6 per 100 ha. Place 1 trap for a setting of 20 ha or lower.
  - For scouting of citrus trees or plantings in a non-commercial setting, select either all trees or at least 10 trees per planting. Mark these trees as permanent data trees. In plantings of more than 10 trees, permanent data trees can be selected in a diagonal transect as described above. At least 10 flush shoots should be checked per tree when present. Scouting should be conducted at least once every 2 weeks.

- A map of the trapping and scouting data trees in the 800-m buffer zone should be available and kept up to date
- Use a magnifying glass (minimum 2.5× magnification) for inspection of traps and scouting
- Keep scouting and trap data records with date of inspection, number of HLB vectors per tree or trap

(D) Record keeping

- Data from scouting and trap reading in- and outside insect-secure structures, including the results from the CRI-CRC's Diagnostic Centre should be recorded and be kept for auditing and risk assessment purposes

(E) Staff training guidelines

- "Citrus pest monitoring (scouting)" e-learning course available from Citrus Academy https://citrusacademy.org.za/wp-content/uploads/2021/03/Citrus-Production-E-Learning.pdf
- Various other applicable training and scouting resources available from Citrus Academy (https://citrusacademy.org.za/shop-2/)
- CRI Cutting Edge no. 240: Surveillance of the Asian Citrus Psyllid in citrus production areas in Southern Africa

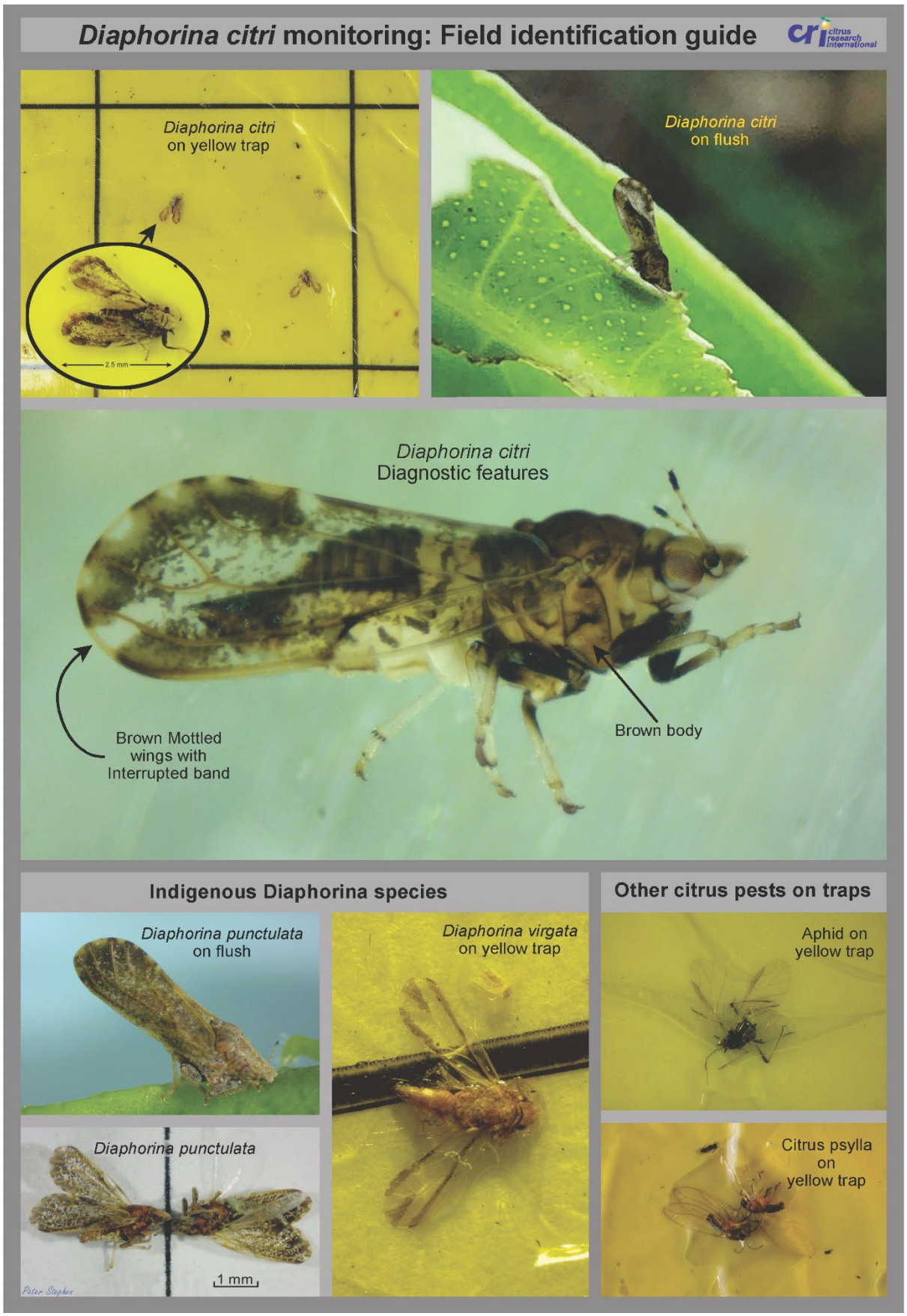

Figure 1. Field identification guide for *Diaphorina citri* and related species.

Figure 2. Field identification guide for *Trioza erytreae*.