Maintaining a citrus gene bank

Tim Herrmann
Australian Citrus Propagation Association Inc

Project Number: CT09002

CT09002

This report is published by Horticulture Australia Ltd to pass on information concerning horticultural research and development undertaken for the citrus industry.

The research contained in this report was funded by Horticulture Australia Ltd with the financial support of Auscitrus.

ISBN 0 7341 2381 7

Published and distributed by:
Horticulture Australia Ltd
Level 7
179 Elizabeth Street
Sydney NSW 2000
Telephone: (02) 8295 2300
Fax: (02) 8295 2399

CT09002

(Completion date 30/06/2010)

Maintaining and developing a citrus gene bank

Author:

Tim Herrmann

Research Provider:

Australian Citrus Propagation Association Inc

Project number:

CT09002

Completion date:

30/06/2010

Project title:

Maintaining and developing a citrus gene bank

Project leader:

Tim Herrmann
Auscitrus Manager

Contact details:
PO Box 269
Dareton NSW 2717
Ph 03 5027 4411
Fax 03 5027 4744
Mob 0417 570065
Email tim.herrmann@auscitrus.com.au

This is the final report for project CT09002.

Funding for this project is through Horticulture Australia Limited, with a voluntary contribution from Auscitrus own funds.

Report date: 21 June 2010

Contents

Media Summary

A source of disease free, true to type genetic material must be maintained by the Australian Citrus industry to protect it from the spread of both exotic and endemic graft transmitted disease, thereby protecting the industry from reduced productivity due to diseased orchards.

A key component of this is the maintenance of the insect proof repository, which provides the citrus industry (through the not for profit industry organisation Auscitrus) with high quality material to establish budwood source blocks. This resource is an industry asset, and should be highly valued as a key component of a holistic biosecurity plan for the Australian citrus industry.

This project has successfully improved and maintained the existing virus free/pre-immunised repository system by moving just over half of the existing virus free foundation trees to a new insect proof repository at Dareton NSW. The maintenance of two insect proof repositories provides a level of redundancy should a catastrophic event such as fire, vandalism, or disease infection occur at one of the sites.

A single tree of each variety has been retained at the virus free repository at EMAI Camden NSW, to provide a backup source of genetic material should it be required.

Additionally, pre-immunised trees of all grapefruit varieties have been held at EMAI, which provide a source of grapefruit genetic material which has been immunised against the severe strains of grapefruit stem pitting tristeza virus.

Technical summary

One virus free tree of each variety has been maintained in insect proof conditions at the NSW I&I facility at EMAI Camden.
One or more virus free trees of each variety have been maintained under insect proof conditions at the Auscitrus facility at River Road, Dareton NSW
Two or more pre-immunised trees of each grapefruit variety have been maintained under insect proof conditions at the NSW I&I facility at EMAI Camden.

No testing was performed on the trees in 2009/10 due to funding restrictions.

Introduction

The not for profit industry organisation trading as Auscitrus (Australian Citrus Propagation Association Inc) supplies disease tested true to type citrus seed and budwood to the Australian citrus industries, through sales of seed and budwood to citrus nurseries. Auscitrus is currently the only organisation supplying commercial quantities of tested budwood to Australian growers and nurseries. Auscitrus relies on accessing disease tested true to type parent material from the citrus foundation repository to establish high health status budwood trees.

The citrus industry needs to maintain a resource of high health status foundation trees to allow Auscitrus access to clean parent material. In the event of a serious disease incursion into Auscitrus budwood plantings, a clean budwood source is then available to re-establish budwood supply trees.

The repository is managed by Auscitrus to maintain at least two trees of all the significant public citrus varieties in a virus free state. This involves holding trees, already proven to be virus free through testing, in a screened enclosure, thereby preventing infection through insect vectors. One tree of each variety is held in the screenhouse located on the NSW DPI facility in Camden, NSW, and at least one is held in the screenhouse located on the Auscitrus property in Dareton, south western NSW. Due to funding restrictions the trees were not tested for disease during the term of this project, however future projects must include ongoing testing.

The Auscitrus Executive Committee, through the Auscitrus Manager, is responsible for overseeing the maintenance of the repository. It is standard practice for any new public varieties to be moved into the repository immediately following post entry quarantine or shoot tip grafting, while they are still in a known disease free state. These trees remain in the repository indefinitely.

Material and methods

New citrus varieties are imported to Australia through the AQIS Post Entry quarantine system, where material is only released from quarantine if found to be free from known citrus diseases. Auscitrus also conducts shoot tip grafting on new local varieties to remove viruses and viroids, creating high health status parent trees. These trees are then maintained in an insect proof repository for virus free clones to prevent infection by insect disease vectors, and tested regularly to confirm their continuing high health status.

This repository contains two or more trees each of 112 public varieties, along with several private varieties which are funded by the variety owners and not part of the scope of this project. In addition, all grapefruit varieties are pre-immunised with a protective strain of citrus tristeza virus (CTV PB61) to protect them from grapefruit stem pitting strains of the virus present throughout Australia.

The methodology of this project is as follows:

1. Continue to maintain at least one tree of each variety in the repository for virus free citrus clones at EMAI Camden.
2. Shift excess trees of all varieties into the new repository greenhouse for virus free citrus clones on the Auscitrus property in Dareton.
3. Continue to maintain pre-immunised trees of all grapefruit varieties.
4. Maintain all trees in a virus free state by careful control of access and sterilisation of equipment between trees.
5. Encourage fruiting of all repository trees to allow confirmation of trueness to type of each tree.
6. Cease the maintenance of the field repository currently at Dareton.

The existing insect proof repository has been maintained at the NSW I&I facility in Camden NSW (Elizabeth Macarthur Agricultural Institute), with NSW I&I funding the replacement of the roof this financial year through their capital works program. The pre-immunised trees were also maintained in a separate insect proof greenhouse at EMAI.

The backup field repository on the NSW I&I Research station in Dareton NSW has been retired, however NSW I&I continue to maintain the trees, although they can no longer be regarded as foundation trees.

A new insect proof repository greenhouse has recently been completed on the new Auscitrus property also in Dareton NSW. One tree of each variety was left at Camden and all others were freighted overnight to Dareton in an enclosed and dedicated truck.

All operations in the repositories are carefully managed, with cutting tools dedicated to each area and sterilised between trees by a 10 second dip in a 1.25ppm solution of sodium hypochlorite. No plant material is allowed into or out of the repositories without the express permission of the Auscitrus manager, following proof of disease freedom either through clearance through AQIS Post Entry Quarantine or Auscitrus internal testing. All trees are encouraged to fruit by selective pruning, and regular written and photographic records of fruit are kept to prove trueness to type of the trees in the repository.

Results

The following public citrus varieties have been maintained in the repository for 2009/10

Accession No.	Variety	Virus free trees	Pre-immunised trees
Grapefruit			
I.N. 91.0736	Flame	*	*
I.N. 89.0620	Henderson	*	*
A.N. 73.0068	Marsh (3970 Druitt)	*	*
A.N. 91.0632	Marsh (3962 Druitt)	*	
I.N. 89.0619	Ray Ruby	*	*
I.N. 89.0708	Rio Red	*	*
I.N. 89.0709	Star Ruby	*	*
A.N.04.0950	Star Ruby (Cant)	*	*
A.N. 91.0633	Thompson (N Eagle)	*	*
Pummelo			
I.N. 01.0925	Namroi	*	*
I.N. 94.0786	Tambun	*	
Citron			
I.N. 01.0926	Bergamia Bergamot Castagnaro	*	*
I.N. 94.0904	Buddha's Hand	*	*
	Etrog	*	
Lemon			
I.N. 01.0927	Eureka (Allen)	*	*
A.N. 75.0034	Eureka (Lambert)	*	*
A.N. 75.0035	Eureka (Taylor)	*	*
I.N. 89.0703	Fino	*	
A.Q. 93.0785	Lemonade	*	
I.N. 00.0918	Lisbon (Limoneira 8A)	*	*
I.N. 75.0036	Lisbon (Prior)	*	
A.Q. 91.0631	Lisbon (Queensland)	*	*
I.N. 89.0705	Verna	*	*
Lime			
I.N. 94.0776	Kaffir lime (Malaysia 4669)	*	*
A.D. 97.0907	Kaffir lime (Nathanael)	*	*
I.N. 00.0916	Kaffir lime (Eyles)	*	*
A.N. 08.0969	Tahiti lime	*	
A.N. 90.0771	West Indian lime (Schweppes)	*	*
Orange			
Navel			
I.N. 86.0600	Atwood	*	*
A.Q. 78.4021	Benyenda - thorny	*	*
I.N. 86.0597	Fisher	*	*
I.N. 99.0912	Fukumoto	*	*
A.S. 75.5077	Hockney	*	*
A.N. 73.0073	Houghton	*	*
A.S. 92.0772	Hutton	*	*
A.N. 75.0032	Lanes Late 3976	*	
A.N. 73.0072	Leng	*	
A.V. 94.0781	Lloyd/3 Leng	*	
I.N. 86.0550	Navelate	*	
I.N. 87.0546	Navelina Spain 7.5	*	*
I.N. 93.0899	Navelina 315 ex Italy	*	*
A.S. 92.0773	Neilson	*	*
I.N. 86.0598	Newhall California	*	*
I.N. 87.0551	Newhall 55-1 Spanish	*	*

Accession No.	Variety	Virus free trees	Pre-immunised trees
Orange cont.			
A.S. 75.5074	Thomson	*	
Valencia			
A.S. 75.5095	B/3010	*	
A.Q. 75.4022	Benyenda	*	*
A.S. 94.0782	Berri 3501	*	*
A.V. 94.0780	CSIRO 5	*	*
A.V. 93.0774	Jenner 4439	*	*
A.N. 75.0029	Newton – Keenan 3125	*	*
A.N. 75.0030	Newton – Keenan 3247	*	
I.N. 92.0901	Acidless orange (Lima 156)	*	*
I.N. 98.0921	Blood orange (Sanguine)	*	*
I.N. 08.0968	Blood orange (Tarocco Ippolito)	*	
I.N. 07.0965	Blood orange (Tarocco Meli C8158)	*	
I.N. 07.0966	Blood orange (Tarocco Rosso C4977)	*	
I.N.06.0960	Common orange (Bintangchen no 2)	*	
I.N. 08.0973	Common orange (Bintang Cheng Renbin # 5)	*	
I.N. 94.0902	Common orange (Delta seedless)	*	*
I.N. 86.0548	Common orange (Hamlin)	*	*
I.N.06.0959	Common orange (Jincheng 447)	*	
I.N. 94.0903	Common orange (Midknight)	*	*
I.N. 92.0900	Common orange (Natal)	*	*
I.N. 86.0549	Common orange (Parson Brown)	*	
I.N. 90.0741	Common orange (Pera Olympia)	*	*
I.N. 90.0742	Common orange (Pera Limeira)	*	*
I.N. 87.0547	Common orange (Pineapple)	*	
I.N. 93.0860	Common orange (Salustiana)	*	*
A.Q. 78.4020	Common orange (Smith - Joppa)	*	
I.N. 97.0924	Pigmented navel (Cara Cara)	*	*
Mandarin			
I.N. 99.0909	W. Murcott Afourer	*	*
I.N. 99.0913	Avana Tardivo	*	
I.N. 99.0914	Avana Apireno	*	*
I.N. 98.0920	Clementine (Caffin)	*	*
I.N. 89.0704	Clementine (Clementard)	*	*
I.N. 99.0910	Clementine (Corsica 1)	*	
I.N. 99.0911	Clementine (Corsica 2)	*	
I.N. 87.0544	Clementine (Fina)	*	*
I.N. 87.0552	Clementine (Marisol)	*	
I.N.05.0957	Clementine (Nour)	*	*
I.N. 87.0543	Clementine (Nules)	*	
I.N. 04.0955	Clementine (Orogrande)	*	*
I.N. 87.0545	Clementine (Oroval)	*	
I.N. 04.0953	Clementine (Sidi Aissa)	*	*
I.N. 91.0733	Daisy	*	*
I.N. 90.0736	Encore	*	
I.N. 08.0974	Etna	*	
I.N. 89.0707	Fallglo	*	
I.N. 93.0859	Fortune	*	
A.Q. 94.0787	Fremont	*	
A.N. 75.0041	Hickson	*	
A.N. 75.0043	Imperial 0043/2	*	
A.Q. 94.0778	Nova (Trott)	*	*
I.N. 91.0734	Nova (Spain)	*	
I.N. 04.0951	Parsons Special /2	*	
I.N. 86.0599	Pixie	*	
I.N. 04.0954	Primosole	*	*

Accession No.	Variety	Virus free trees	Pre-immunised trees
A.N. 75.0065	Satsuma (Silverhill)	*	
I.N. 89.0706	Satsuma (Clausellina)	*	
I.N. 91.0852	Satsuma (Okitsu Wase)	*	*
I.N. 91.0853	Satsuma (Miho Wase)	*	*
A.Q. 94.0886	Sunburst	*	
Tangor/elo			
A.N. 75.0090	Ellendale (Herps)	*	*
A.Q. 04.0952	Murcott tangor (Benham)	*	
A.Q. 90.4149	Murcott tangor (Turner)	*	
I.N. 90.0818	Topaz tangor	*	
Cumquat			
I.N. 04.0956	Nagami	*	*

Discussion

All trees were maintained in good health for the 12 month period covered by this report. As funding was not provided for disease indexing, no indexing results are available.

The following budwood was utilized from these trees in this time period to establish budwood source trees for the Auscitrus multiplication block at Dareton NSW:

Variety	No. buds
Bingtang Chen renbin #5	60
Tarocco Ippolito	144
ben yenda valencia	60
delta	60
hamlin	60
midknight	60
parson brown	24
pineapple	60
Salustiana	60
Tahiti Lime VF	120
atwood	24
ben yenda navel	24
fisher	36
lane	120
newhall c	60
thomson navel	12
afourer	120
caffin	60
imperial	180
miho	24
Murcott	120
nules	36
ray ruby	24
rio red	48
star ruby	48
thomson red fleshed	12
buddhas hand	36
Kaffir eyles	48
kaffir malay	24
kaffir nathaneal	48

Technology Transfer

A list of the varieties held in the repositories was listed in the 2009 Auscitrus Annual report.

Several groups of growers and nursery operators were toured through the facilities, although physical access to the inside of the houses was restricted for biosecurity reasons.

Recommendations

This project should be considered an ongoing commitment, with a long term view to the maintenance of this industry asset.

As funding was not available for disease indexing at the time of submission of this project, it has been postponed for 12 months, however it MUST be recommenced immediately.

A follow up VC project CT10008 aims to secure funding on an ongoing basis for the maintenance and disease indexing of the repository trees. This project should be supported to ensure this valuable asset remains available to the Australian Citrus Industry.

Acknowledgements

The management of NSW I&I at EMAI, Camden NSW has been supportive of the maintenance of the repository at their site, putting funds forward for the refurbishment of the insect proof screenhouse. In particular the efforts of Dr Nerida Donovan must be acknowledged for her excellent work in overseeing the day to day management of the EMAI repository.