



Southern African Citrus Improvement Scheme

Citrus Improvement Scheme,
a division of Citrus Research International (Pty) Ltd,

Uitenhage, South Africa

Email: cis@cri.co.za



Citrus Improvement Scheme (CIS)

🍊 Why..?

- To increase the profitability of the southern African Citrus Industry, by ensuring that citrus growers are supplied with nursery trees of
 - the *highest possible quality*
 - made from *true-to-type* citrus material and
 - being *free from harmful pathogens*



CIS – present status and structure

- 🍊 Voluntary public (non-statutory) scheme
- 🍊 Operated by Citrus Research International on behalf of RSA citrus industry
 - Stakeholders:
 - Citrus growers, Citrus Growers' Association of Southern Africa
 - Department of Agriculture, Forestry and Fisheries
 - Agricultural Research Council
 - Citrus nurseries, SA Citrus Nurserymen's Association (SACNA)
 - Cultivar owners
 - Private Cultivar Management Companies



Citrus Foundation Block



Citrus Foundation Block



Citrus Foundation Block



Citrus Foundation Block

🍊 RSA's primary source for citrus propagation material

- Rootstock seed
 - ≈7 hectares with 23 rootstock cultivars
- Budwood
 - ≈ 130,000 multiplication trees of >360 cultivars
 - Housed in >2.5 ha insect proof greenhouses
 - Total potential stock of >10 million buds per annum

🍊 Secluded position to ensure biosecurity

- 40 km away from commercial citrus production areas
- 5 km buffer zone surrounding CFB
 - No commercial or home-garden plantings of *Citrus* or related genera allowed
- Official annual inspections to confirm freedom of regulated diseases (Citrus Greening and Citrus Black Spot)



Rootstock cultivar orchards



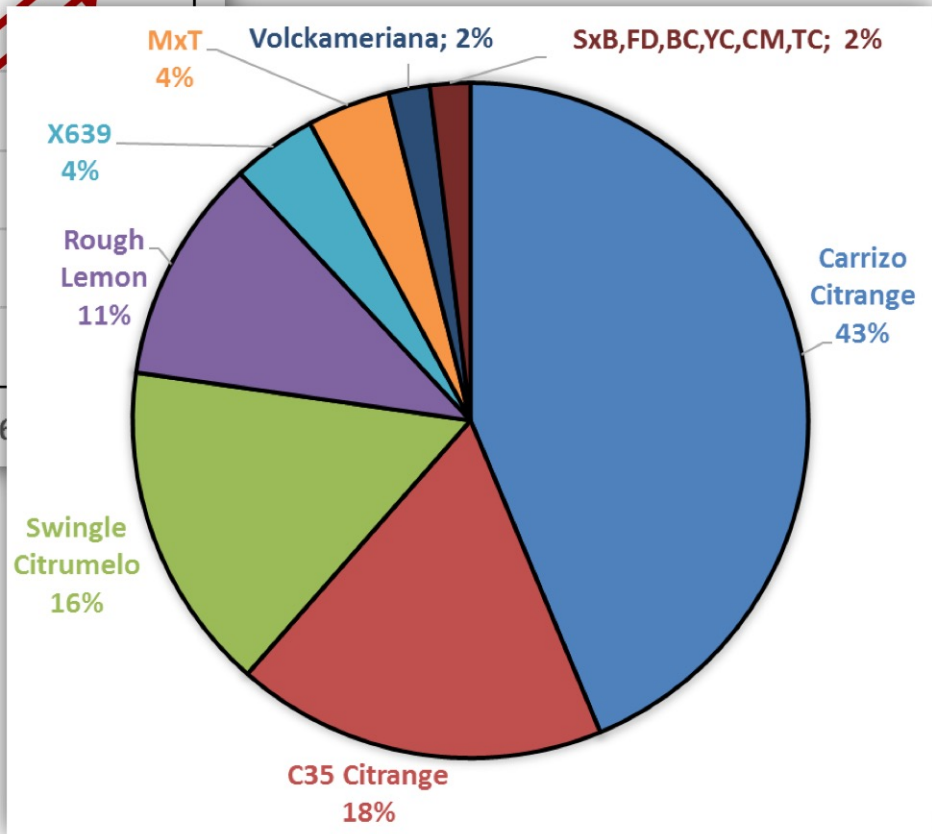
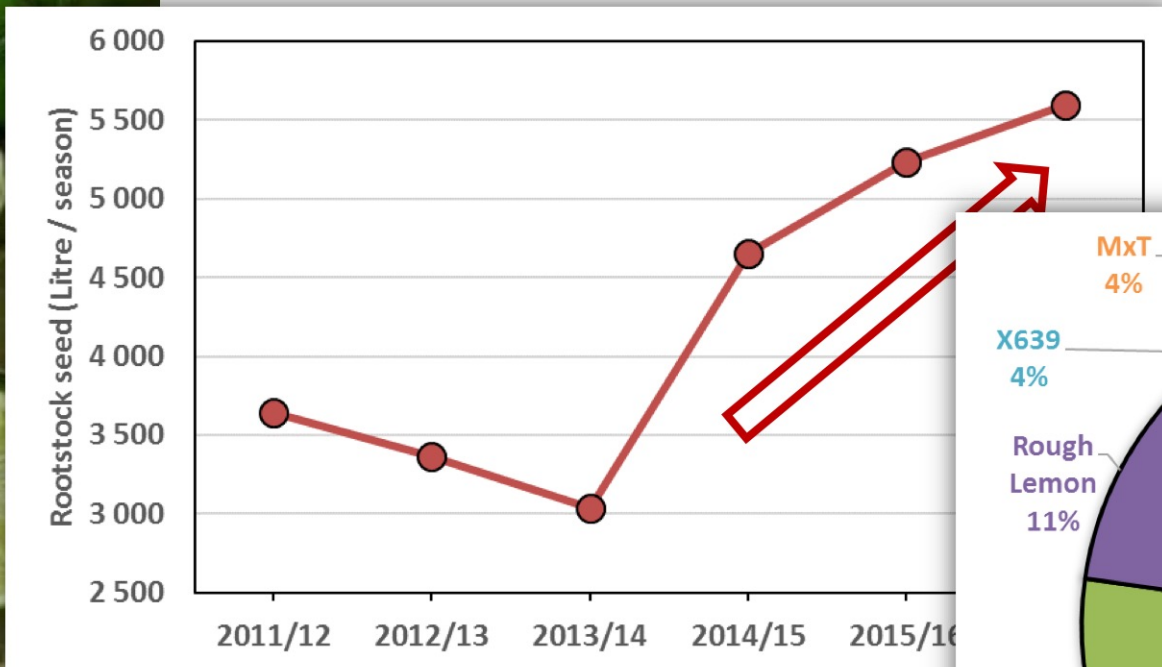
New rootstock orchards



Seed harvested from fruit



Statistics: Seed supply



Seed processing



CITRUS RESEARCH INTERNATIONAL P.O. Box 2945, UITENHAGE, South Africa, 6230	
Certified Citrus Seed	
Cultivar	C35 Citrange
Code	Or16/17/01
Volume	2 liters
Processed	7 May 2005



Budwood production



Budwood production





Cultivar introduction into CIS

🍊 Imported cultivars

- Mandatory post-entry quarantine, including pathogen elimination by means of shoot-tip grafting (ARC-Nelspruit)

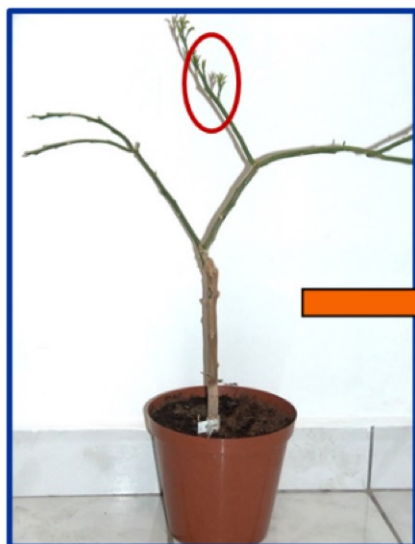
🍊 Locally bred or selected cultivars

- Mandatory pathogen elimination (STG) at ARC-Nelspruit or CRI-Nelspruit

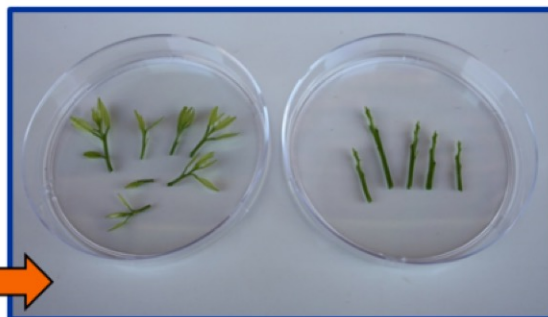
🍊 Shoot-tip grafting

- Pathogen elimination and diagnosis process, which takes 2-3 years
- All cultivars introduced as pathogen-free

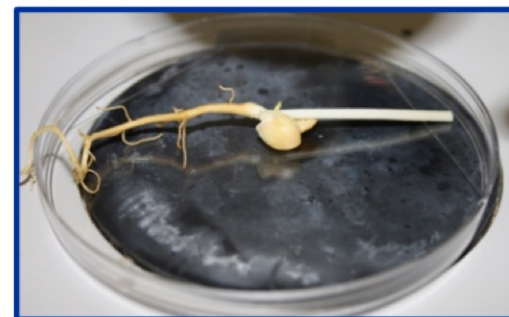
Pathogen elimination by shoot-tip grafting



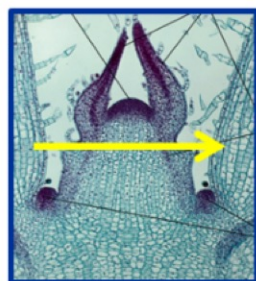
- Defoliate new source
- Allow new shoots to develop



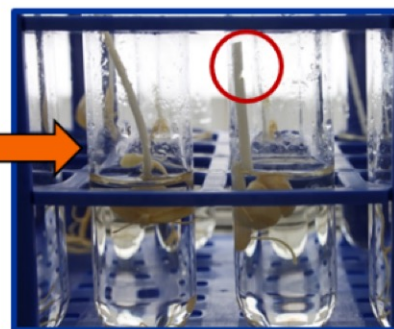
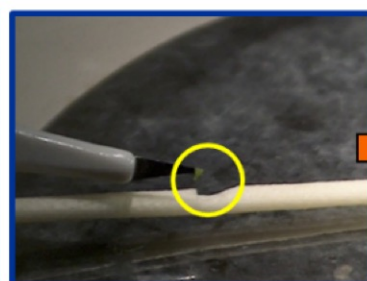
- Collect new shoots
- Sterilise 5 min in 7.5% Jik
- Rinse 3x in sterile distilled water



- Prepare etiolated rootstock from test tube



- Cut 0,15 mm off growth point under stereo microscope
- Transfer to rootstock in upright position on phloem

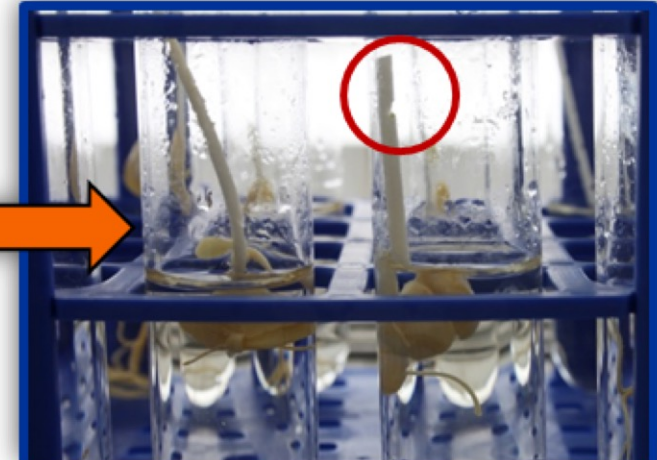
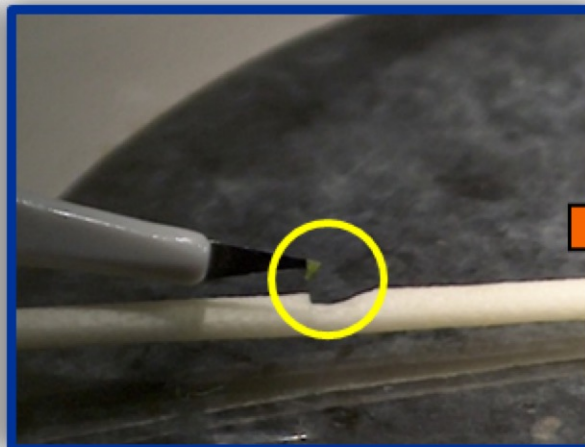
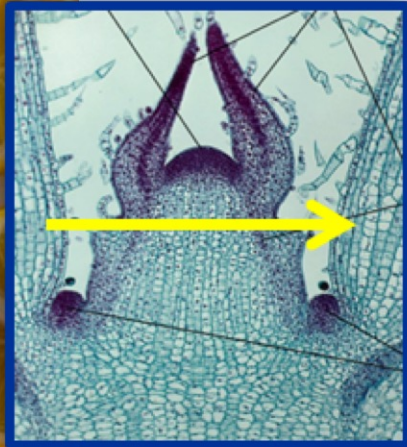


- Transfer into liquid medium
- Label the test tube



- Transfer to growth room at 28°C

Pathogen elimination by shoot-tip grafting



Pathogen elimination by shoot-tip grafting



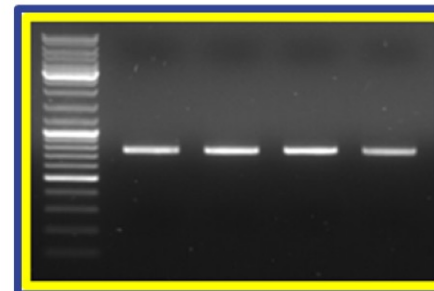
If successful, growth will occur in approximately 4 weeks



- Remove plant from test tube
- Cut 4 cm off plant (rootstock with shoot tip)
- Micro-graft onto virus-free rootstock
- Cover with plastic bag for 7 days



Transfer to glasshouse at 28°C



Once grown out sufficiently, confirm if negative for CTV via direct RT-PCR

Cultivar introduction into CIS

🍊 *Citrus tristeza virus* (CTV) cross-protection

- Mandatory cross-protection of all cultivars, except lemons and rootstocks

🍊 Virus-free line of cultivar maintained in nucleus block (ARC / CRI)

🍊 CTV cross-protected line maintained and multiplied at Citrus Foundation block

- Regularly re-indexed to confirm disease-free status

Rapid multiplication in heated tunnel



Rapid multiplication in heated tunnel



True-to-type evaluation: Mother trees



TtT evaluation block



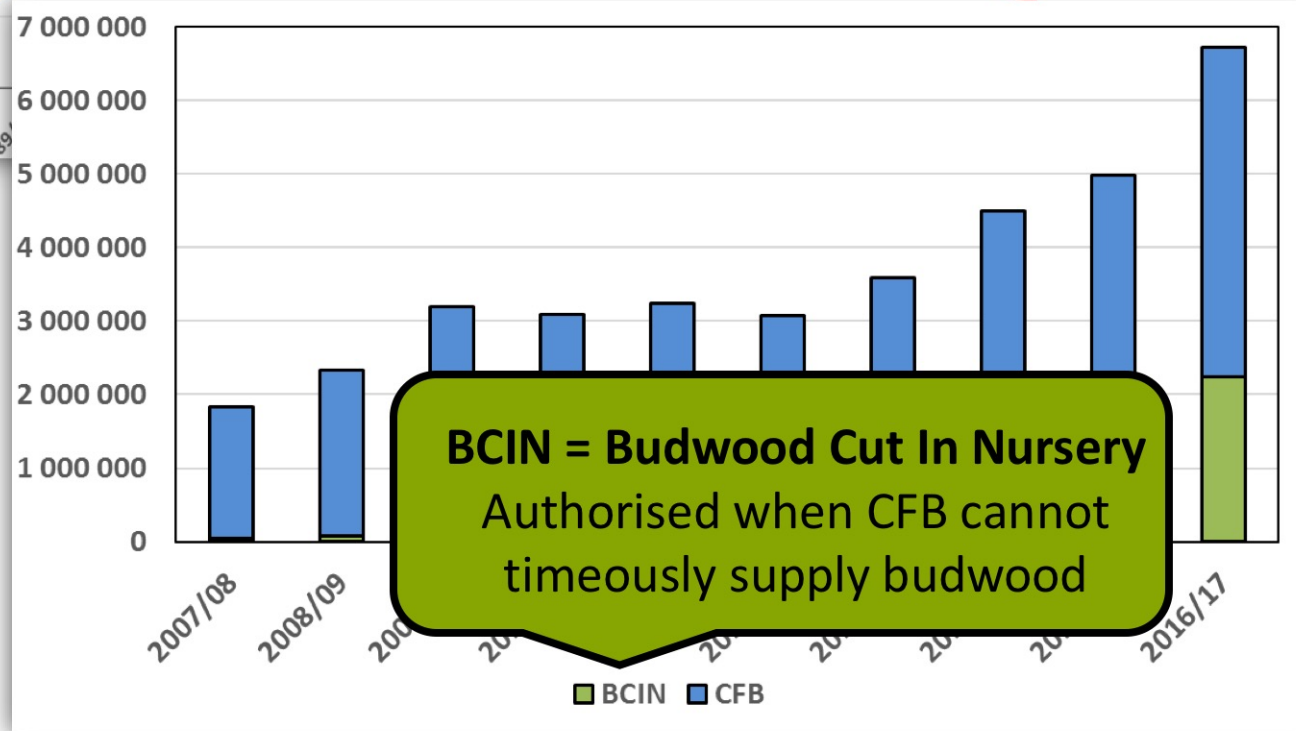
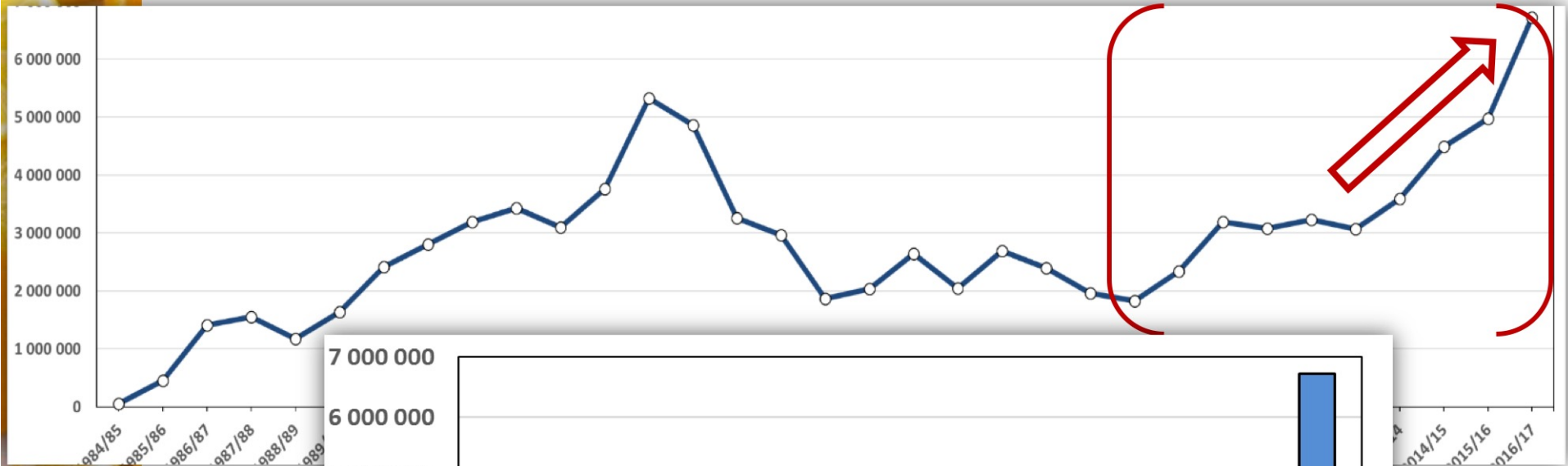
Multiplication trees



Budwood supply



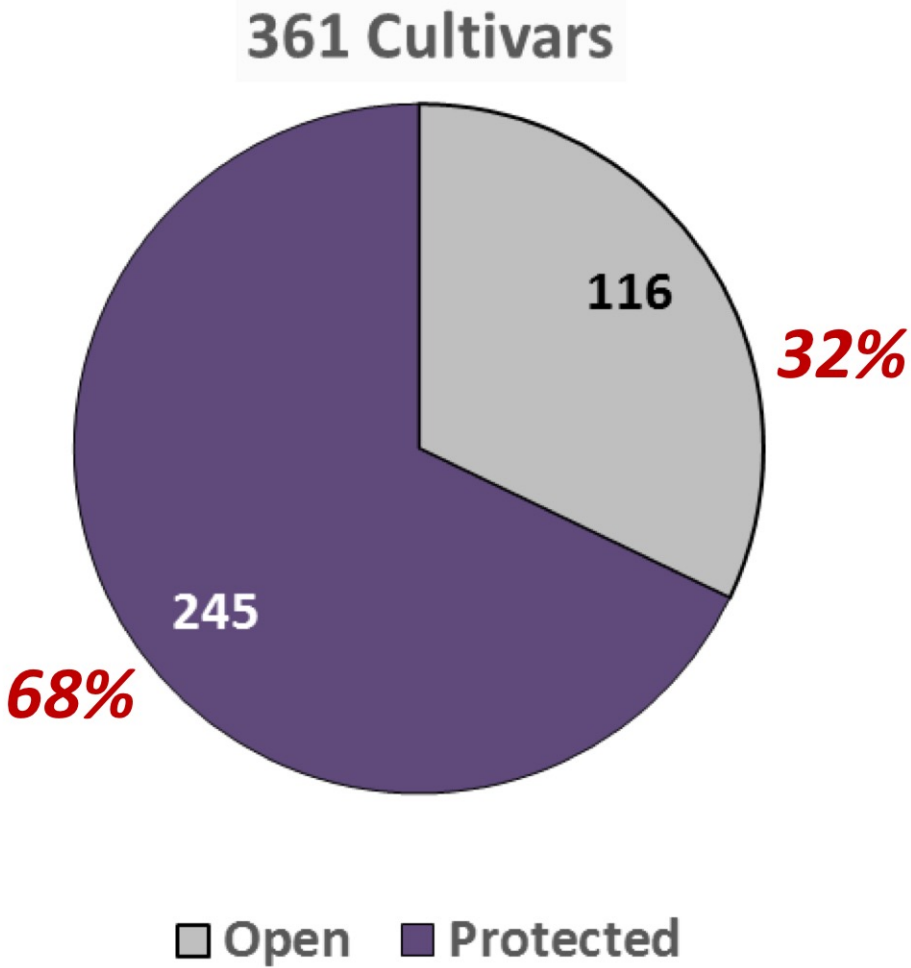
Statistics: Budwood supply



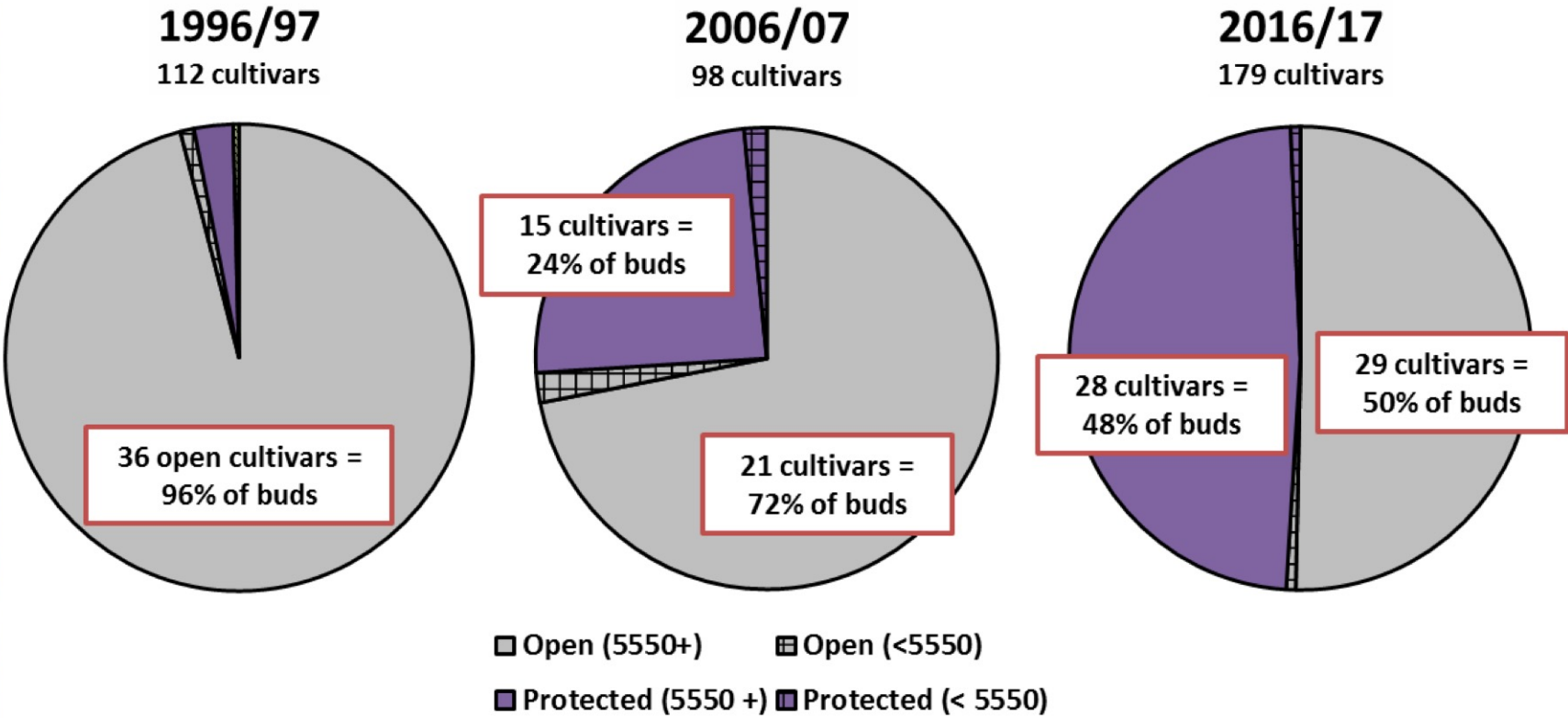
BCIN = Budwood Cut In Nursery
 Authorised when CFB cannot
 timeously supply budwood



Cultivars at CFB: July 2017



Number of cultivars supplied



Budwood demand prediction

Variety Type	Cultivar	INCREASE TREES TOTAL	2011 Total	2012 Total	2013 Total	3-yr Avg Demand	2013 Rank	Total Stock	2014 Prediction (Based on 3yr Avg demand)	2015 Prediction (Based on 3yr Avg demand)	2016 Prediction (Based on 3yr Avg demand)	2014 Predicted Shortfall	2015 Predicted Shortfall	2016 Predicted Shortfall	NEW TREES NEEDED	Trees to be made: Nov'13	Trees to be made: Jan2014	Comments
Lemon	Eureka	6,032	537,934	482,984	594,690	538,503	1	289,538	538,503	538,503	538,503	248,967	220,743	192,519	4599	588	588	
Mandarin Hybrid																		
Mandarin Hybrid																		
Navel																		
Mandarin Hybrid																		
Valencia	Late	110,645	164,098	265,111	265,111	180,511	2	180,511	180,511	180,511	180,511	28,159	28,159	-65	587		588	
Valencia	Midknight	1,024	348,470	179,801	257,470	262,664	3	262,664	262,664	262,664	262,664	40,712	40,712	13,256	848		572	
Mandarin Hybrid																		
Mandarin Hybrid																		
Navel																		
Clementine																		
Navel																		
Mandarin Hybrid	Nova	1,835	253,339	253,339	253,339	88,080	4	88,080	185,309	185,309	185,309	97,229	69,005	40,781	1438	588	588	Replace open
Mandarin Hybrid	Nova (2)	10				480	5	480	-	-	-	-480	-480	-480	-10			
Lemon	Lisbon	1,599	119,082	123,477	123,477	76,752	6	76,752	118,277	118,277	118,277	41,525	13,301	13,301	277	588		
Valencia																		
Navel																		
Grapefruit	Star Ruby	5,655	131,926	132,210	132,210	76,963	7	271,440	76,963	76,963	76,963	-194,477	-194,477	-74,477	-4052		-2,500	CFB: Reduce i
Valencia	Benny 2	1,781	56,535	100,772	73,571	76,959	8	76,959	80,000	80,000	80,000	-5,488	-5,488	-5,488	-114			
Lemon	Limoneira 8A	822	37,160	134,170	44,540	71,957	9	39,456	71,957	71,957	71,957	32,501	32,501	5,045	677		572	CFB: Budding
Valencia	Delta	1,193	60,751	66,935	43,042	56,909	10	57,212	56,909	56,909	56,909	-355	-355	-355	-7			
Mandarin Hybrid	Empress	726	32,400	47,500	37,410	39,103	11	39,103	39,103	39,103	39,103	4,255	4,255	-545	89		100	CFB: Budding
Lemon	Genoa	654	67,815	8,780	37,340	37,978	12	31,392	37,978	37,978	37,978	6,586	6,586	6,586	137			
Lime	Bearss	609	22,400	49,950	36,770	36,373	13	29,232	36,373	36,373	36,373	7,141	7,141	-59	149		150	CFB: Budding
Mandarin Hybrid																		
Mandarin Hybrid																		
Valencia																		
Clementine	Nules	1,012	46,100	78,500	21,500	48,700	14	48,700	48,700	48,700	48,700	348	154	134	3			
Clementine	Nules (2)	564	-	16,200	7,320	7,840	15	27,072	7,840	7,840	7,840	19,232	-19,232	19,232	-401			
Navel	Washington	3,177	67,742	66,356	21,407	51,835	16	152,496	51,835	51,835	51,835	51,835	51,835	51,835	51,835	-2097		
Satsuma																		
Navel	Bahianinha	2,184	226,615	131,020	20,940	126,192	17	104,832	126,192	126,192	126,192	21,380	21,380	21,380	445			Declining tree
Satsuma	Miho Wase	575	111,000	55,178	19,750	61,976	18	27,600	61,976	61,976	61,976	34,376	34,376	34,376	716			Replace open
Navel	Palmer	1,691	100,295	60,720	16,270	59,095	19	81,168	59,095	59,095	59,095	-22,073	-22,073	-22,073	-460			
Mandarin Hybrid																		
Mandarin Hybrid																		
Valencia																		
Navel	Lina	624	39,199	12,913	12,020	21,377	20	29,952	21,377	21,377	21,377	-8,575	-8,575	-3,775	-179			-100
Valencia																		
Mandarin Hybrid																		
Valencia																		
Mandarin Hybrid																		
Valencia																		
Clementine	Esbal 2 (2)	10	-	-	20	7	40	480	7	7	7	-473	-473	-473	-10			

Total number of increase trees

Predicted stock 48 buds/tree/yr

3-yr average demand

Predicted demand (3 years)

Predicted shortfall (3 years)

Number of increase trees needed / "woert"



CIS – Success story

🍊 Clean industry

- CTV controlled
- Relatively few graft transmissible diseases in commercial orchards
- No incursion of major pests/diseases... yet...

🍊 Status

- Voluntary public (non-statutory) scheme
- >95% participation
- ≈70% of budwood supply directly from CFB
- Unprecedented growth and demand for citrus propagation material straining resources
- Biosecurity threats (HLB + ACP)

🍊 Future improvements needed...

Biosecurity projects



- 🍊 2016 CIS Review
- 🍊 Promulgation of CIS as compulsory statutory scheme
- 🍊 Nursery tree production under insect-protected structures
- 🍊 Pest and disease scouting and monitoring
- 🍊 Ongoing surveys for African Greening and HLB/ACP
 - RSA and southern Africa
- 🍊 Biosecurity research projects (diagnostics, **sniffer dogs**, surveillance, HLB+ACP control)





CIS, nurseries and Biosecurity

- 🍊 Plant disease- and pest-free trees
 - ***Starting clean is the first line of defence!***
 - Prevent spread of pests and diseases
- 🍊 Promulgation of CIS as compulsory statutory Scheme
 - ALL trees in South Africa made from disease-free material
- 🍊 Nursery tree production in insect-secure structures
 - Change-over from shade-house structures required
 - Increase in tree price...?
- 🍊 NB! Support CIS and CIS certified nurseries

Demand a Tree Certificate!





Role of retail nursery sector

- 🍊 Use of pest- and disease-free propagation material
- 🍊 Effective pest and disease control measures during the production and retail stages
- 🍊 Compliance with relevant legislation
 - Legal restrictions on movement of Rutaceae plants as per Regulation 110 of the Agricultural Pest Act

Regulation 110

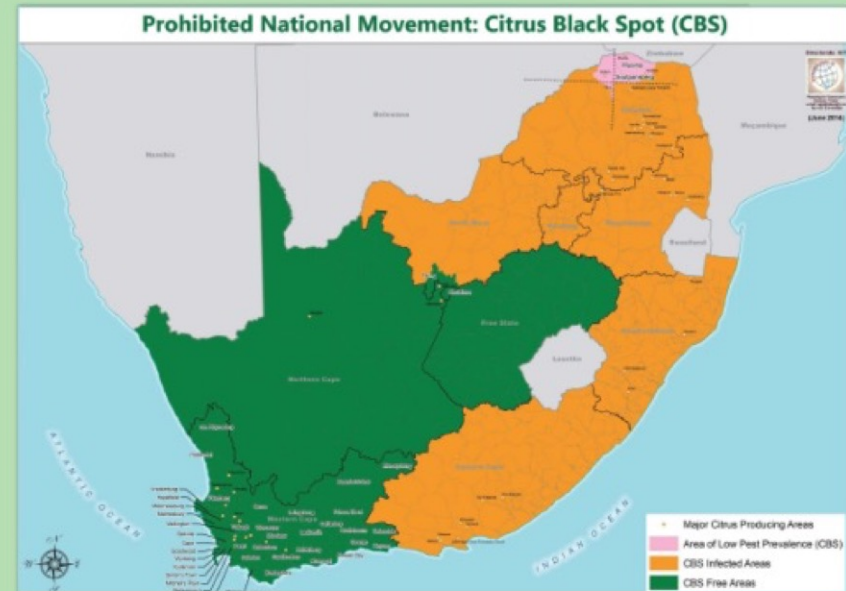
Are you moving Citrus and/or related Plants?

In terms of Agricultural Pests Act, 1983 (Act No. 36 of 1983), movement of citrus and/or related plant propagation material is prohibited from one area to another within the Republic of South Africa, unless the movement is authorised by means of a permit, or the material is certified as pest free.



Movement of citrus and/or related plant propagation material is not allowed from orange area to the green area and is not allowed from orange area to the red area. Furthermore, is not allowed from red area to green area. This will assist in preventing the spread of citrus greening to non-infected area.

Host plants for Citrus Greening
Species of the genera *Aegle*, *Aeglopsis*, *Aleagle*, *Alatalia* (Severine synonymous), *Balsamodiscus*, *Calodendrum*, *Citropsis*, *Clausena*, *Cuscuta*, *Eremodiscus*, *Fagaropsis*, *Peronia*, *Fortunella*, *Hesperethusa*, *Limonia*, *Mirodanthus*, *Murraya*, *Orania*, *Pleocarpium*, *Poncirus*, *Santalum*, *Teclea*, *Toddalia*, *Toddalopsis*, *Tiphelia*, *Vepris*, *Zanthoxylum* and crosses thereof.



Movement of citrus and/or related plant propagation material is not allowed from orange area to the green area and is also not allowed from orange area to the pink area. This will assist in preventing the spread of citrus black spot to non-infected area.

Host plants for Citrus Black Spot
Citrus and species of the genera *Fortunella*, *Limonia*, *Poncirus*, *Santalum* and any cross thereof.

For further information please contact: Directorate Plant Health, Private Bag X14, Gezina 0031
Tel: +27 12 519 6164 Tel: +27 12 519 6525
Email: MaandaP@daff.gov.za Email: LinnethM@daff.gov.za



agriculture,
forestry & fisheries

Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA



Role of retail nursery sector...

🍊 Compliance with relevant legislation

- Legal restrictions on movement of Rutaceae plants as per Regulation 110 of the Agricultural Pest Act
- Ensure compliance with all import requirements
- Compliance with the emergency action plan and quarantine measures (when applicable)

🍊 Creating awareness and educating the general public

🍊 Nurseries must be vigilant and are urged to take action when receiving information that indicates a biosecurity risk or legal transgression

Thank you

Paul Fourie - Email: phf@cri.co.za

