

SITplus Update

25 September 2020

Dan Ryan
Program Director, SITplus Partnership



History



- Program start Nov 2015
- Initial 3 year phase developing underpinning knowledge
- 2nd 3-yr phase testing and refining systems
- Partnership between state governments, Hort Innovation, Universities and NZ research institute
- Primarily funded by partners
- Currently 6 projects
 - Release pilot
 - Factory pilot
 - Development of male-only strain
 - Development of sex-sorting technology
 - Underpinning research





Aim



- By 2023, sterile insect technique will be a viable tool for managing Queensland fruit fly and SITplus will be operating as a sustainable entity
 - Deliver cost effective, efficient release systems
 - Deliver cost effective, efficient production systems
 - Enable sustainable funding
 - Build a shared future vision with industry and government
 - Facilitate a post-pilot operation





Where are we now



- Underpinning research largely completed
- Factory operating reliably and cost-effectively
- Year 1 of pilot releases successfully completed
- Funding models being discussed at National Fruit Fly Council
- SITplus future scenarios developed
- Benefit Cost Analysis and Business Case tender advertised
- Entering consultation phase





Hillston

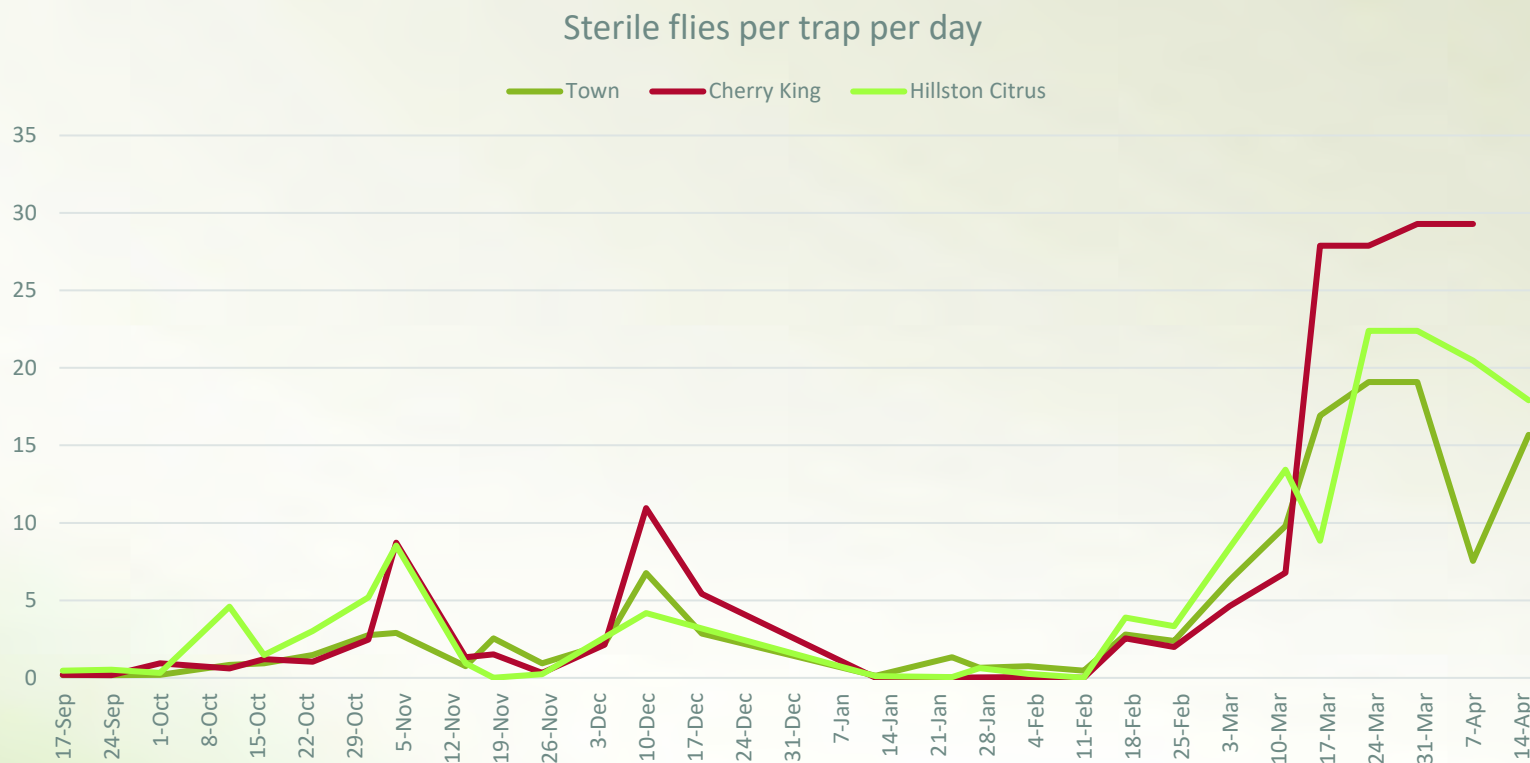


- Trialling remote area-wide program
- Release over 2 large farm partners and urban area
- Urban trapping
 - No more than 4 wild flies in any week, most weeks zero
 - Maximum in a trap 2
 - Sterile recapture peaked strongly in Spring
- Max 1 fly for season on farm



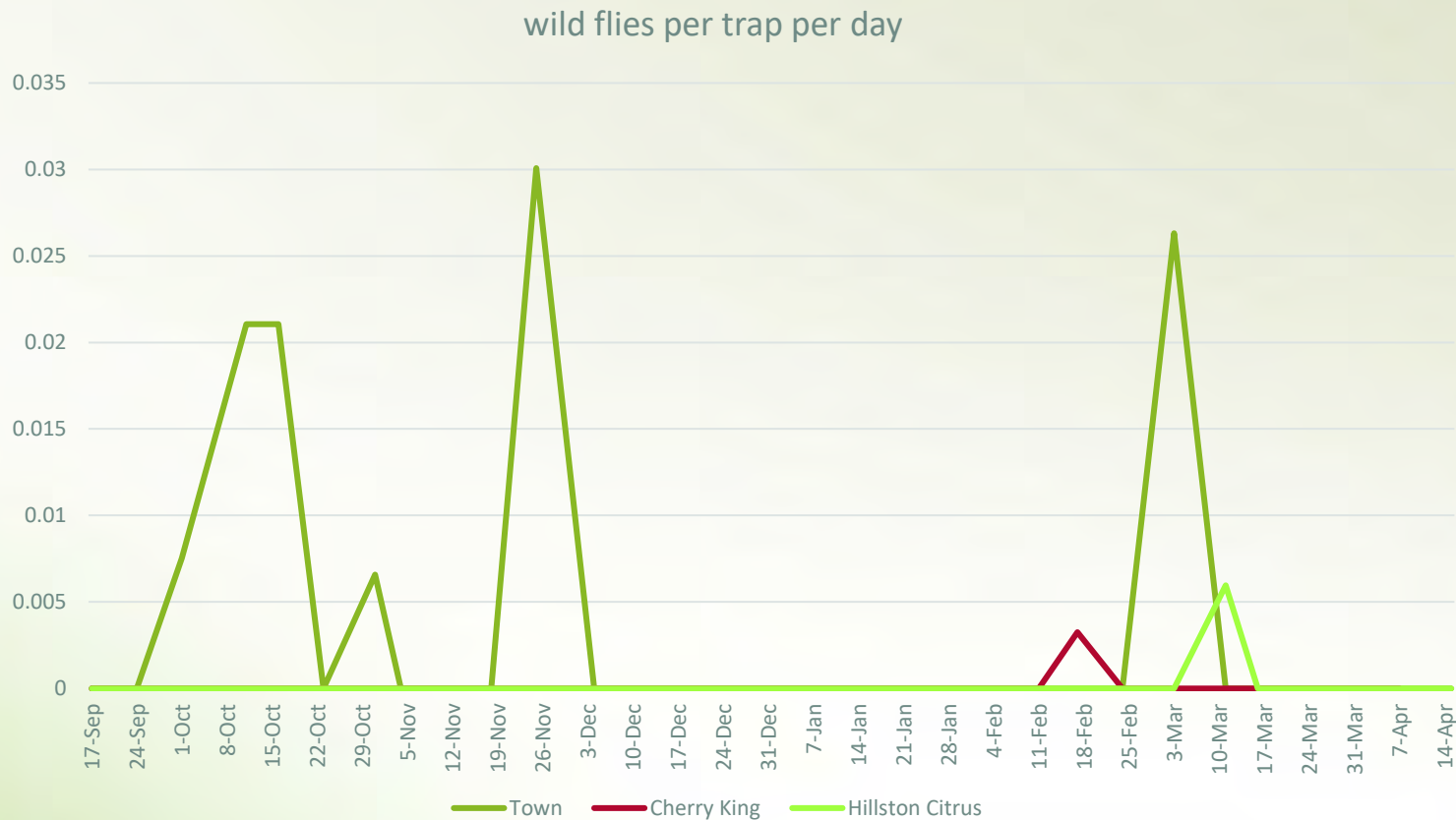


Hillston Sterile recapture





Hillston Wild flies





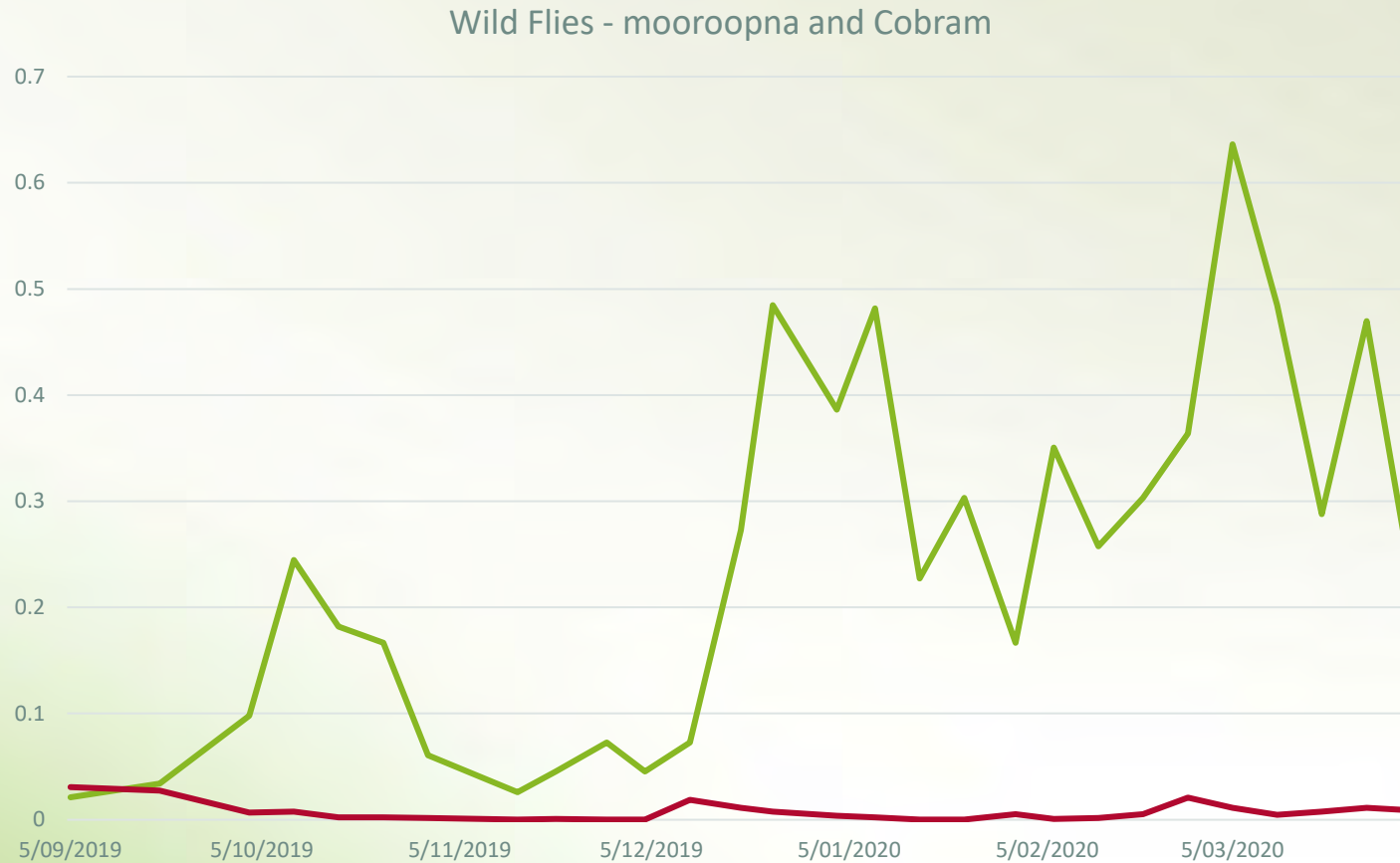
Cobram

- Trialling Urban suppression
- Aim to reduce urban pressure on surrounding farms
- 10-fold decrease in wild flies compared to untreated Maroopna
- In concert with Moira council education and tree removal program
- Positive feedback from Cobram Fruitgrowers





Maroopna/Cobram Wild flies





Trapping data use

- Target overflooding ratio
- Fly longevity (2108/19)
- Population growth model
- Are wild flies generally found in adjacent traps
- Are there hot (consistent catch) and cold (consistent limited catch) traps-
- If there is catch in a trap in one week, is there a higher probability of catch in that trap the following week.
- Covariates rainfall and/or temperature
- Any correlation between temperature and catch?
- Shape of recapture curve





Next steps

- Complete analysis of Season 1 trap data
- Continue with release pilot for season 2 & 3
- Source Benefit Cost Analysis and Business Case
- Consult with industry and Government
- Refine future scenarios
- Identify funding model
- Facilitate implementation of sustainable model

Thank you



Post Factory Pilot of SITPlus

Phil Taylor

Director, ARC Centre for
Fruit Fly Biosecurity Innovation

Head of Applied BioSciences
Macquarie University

**Hort
Innovation**



2013: A Changing Q-Fly Context

- Increased pressure on Southern growing regions
- Restrictions on key chemicals (e.g, dimethoate, fenthion)
 - Reduced options for simple one-step solutions
- A time for new, sustainable, approaches



‘Sterile Insect Technique’?

Adult emergence



Mating



Oviposition



Sterile flies



Pupation (in soil)



‘Popping’



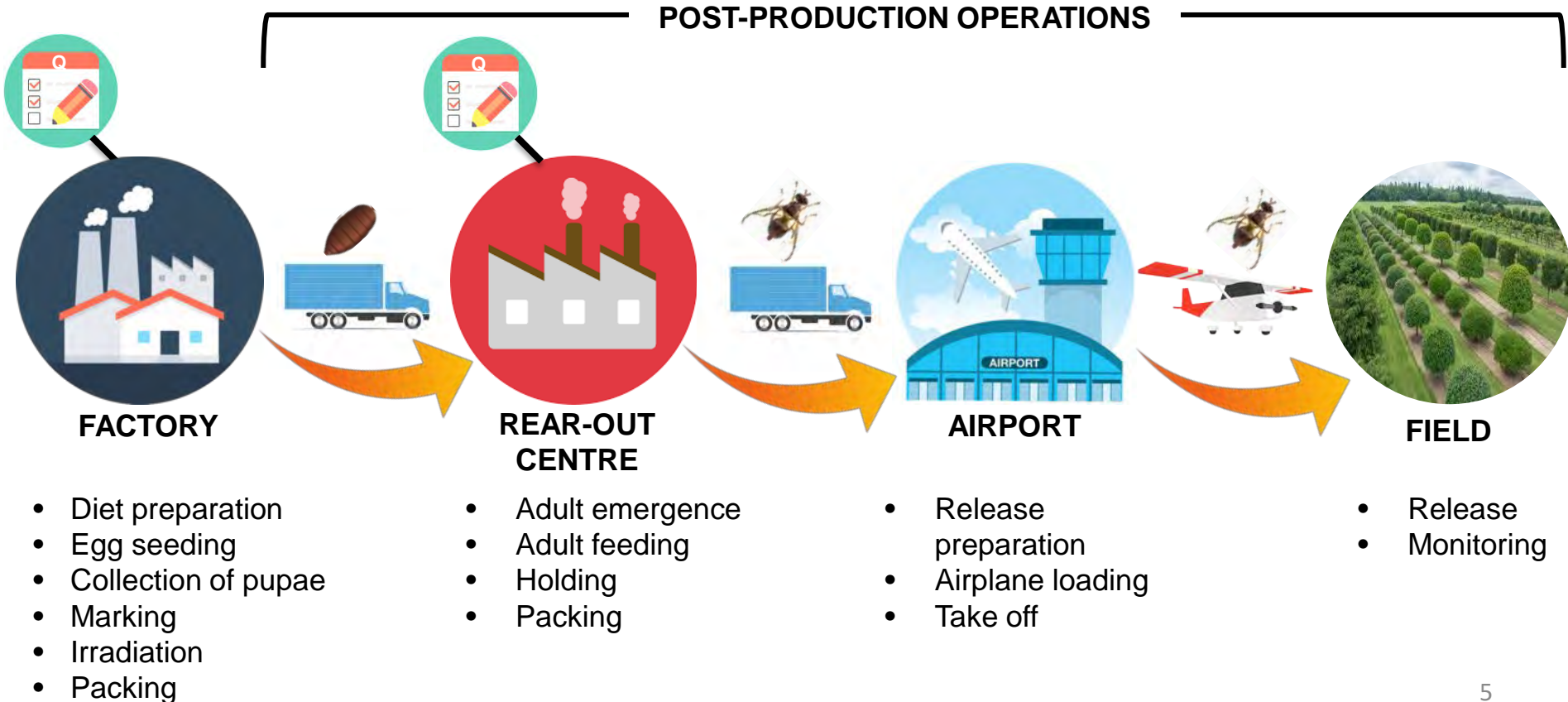
Larval feeding

SIT 're-booted'

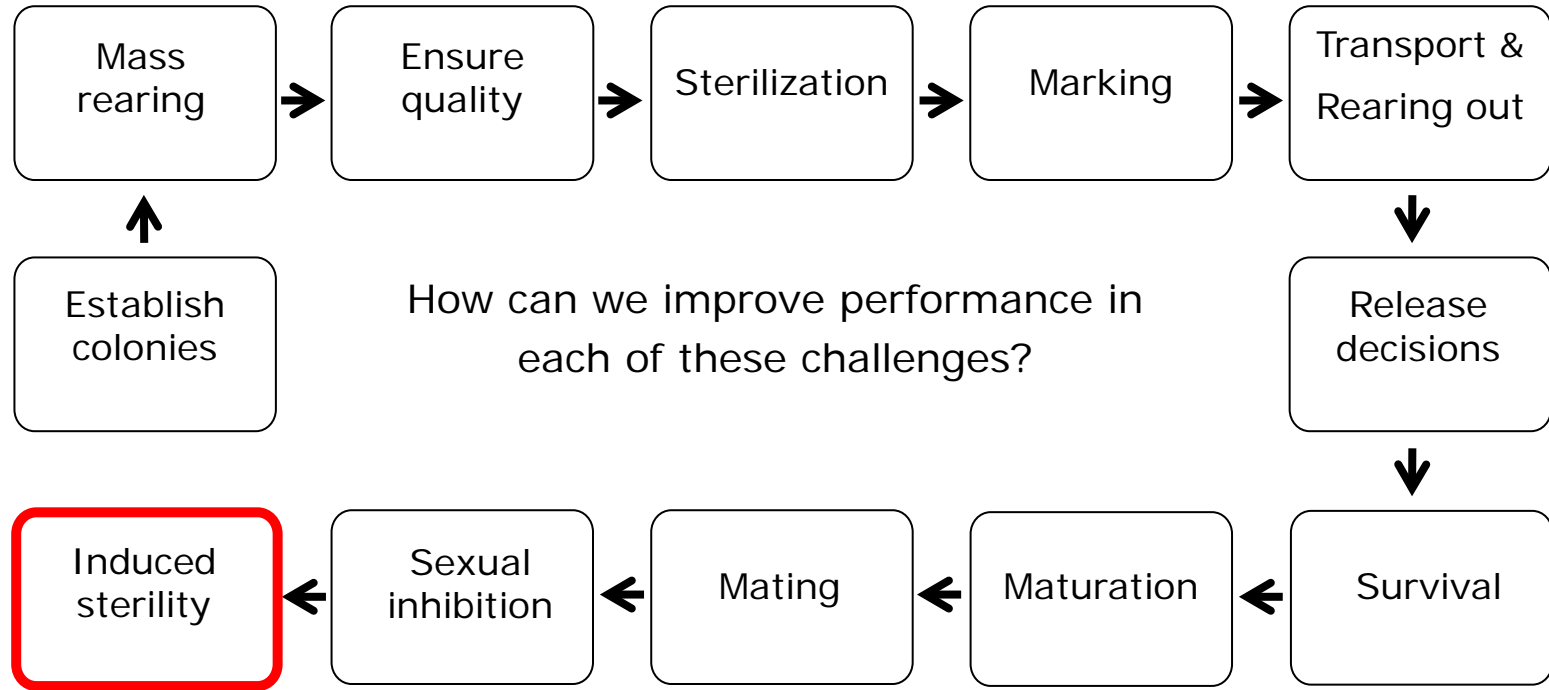
- 'Re-booting' Sterile Insect Technique for Qfly
 - A cost-effective regional approach
 - Within integrated area-wide management
- A bold initiative, and a major investment
- LOTS of challenges, and a short timeline
- Needed wide-ranging research and development



The Operational Processes of SIT



The Sequential Challenges of SIT

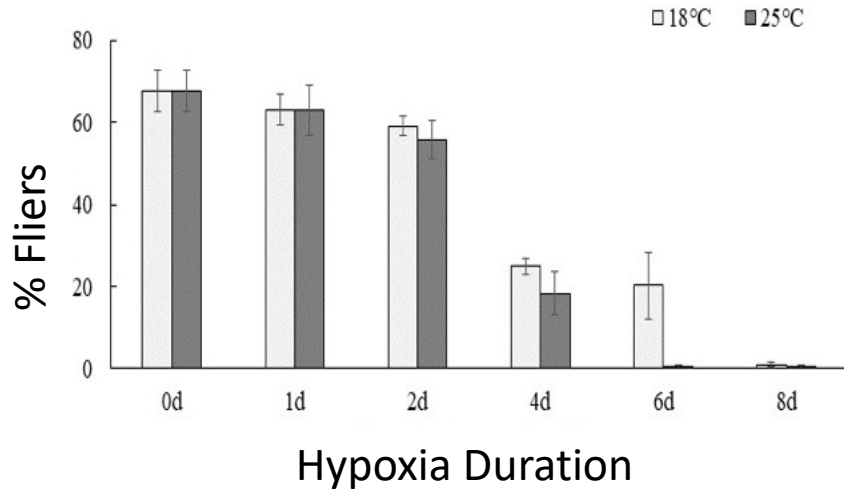


High Productivity Larval Diets



- Previous rearing based on Carrot or Lucerne Chaff
 - Unreliable sources, bulky
- Recent research using liquid diets
 - Don't work well for Q-fly, hard to manage
- Developed gel-based diets
 - High quality flies
 - High productivity

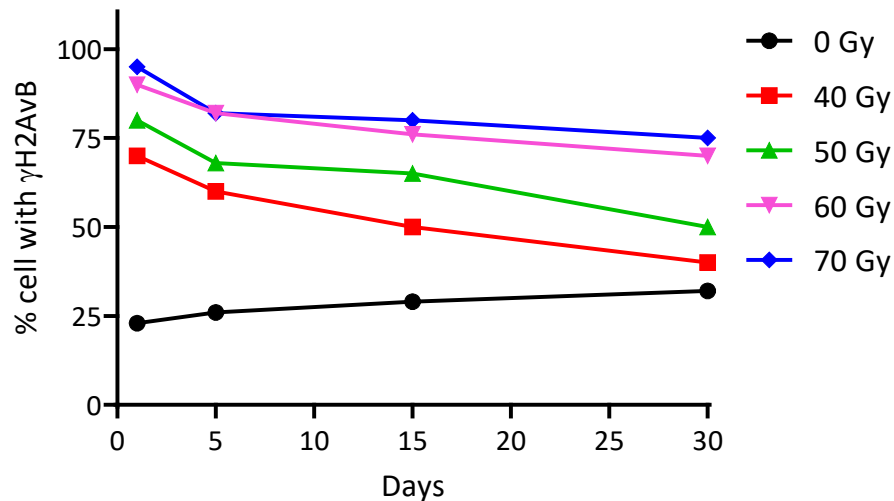
Storage & Transportation of Pupae



- Long distances for transport
- Previous work suggested only small reductions in emergence
- BUT flight performance suffers
- Guidance for transportation

New Identification Tools

- Detailed studies of dye effectiveness and impact (SARDI)
 - Which dye, and how much to use
- Stable isotope ratio tests (Macquarie)
 - Flies are what they eat
- γ H2AvB (SARDI)
 - Persistent IR signature
- Genetics (CSIRO & Macquarie)
 - Factory flies are genetically distinctive

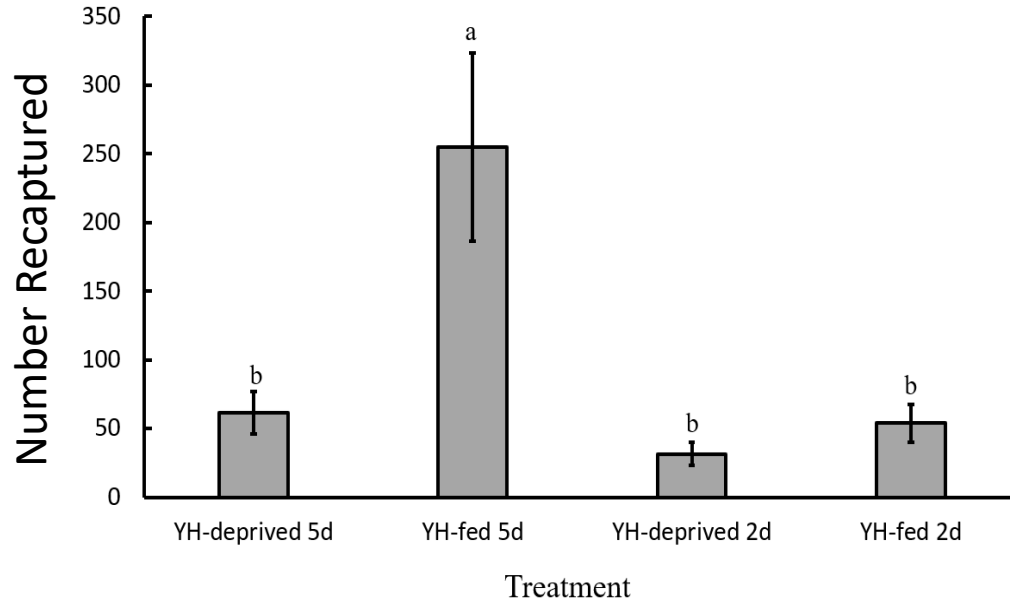


Faster Development & Increased Mating

- Pre-release Nutrition
 - Flies need a balanced diet
- Pre-release Methoprene
 - Hormonal treatment
- Pre-release Raspberry Ketone
 - ‘Fat blaster’ for flies
- Pre-release Caffeine
 - but not coffee or guarana



Improved Release Timing



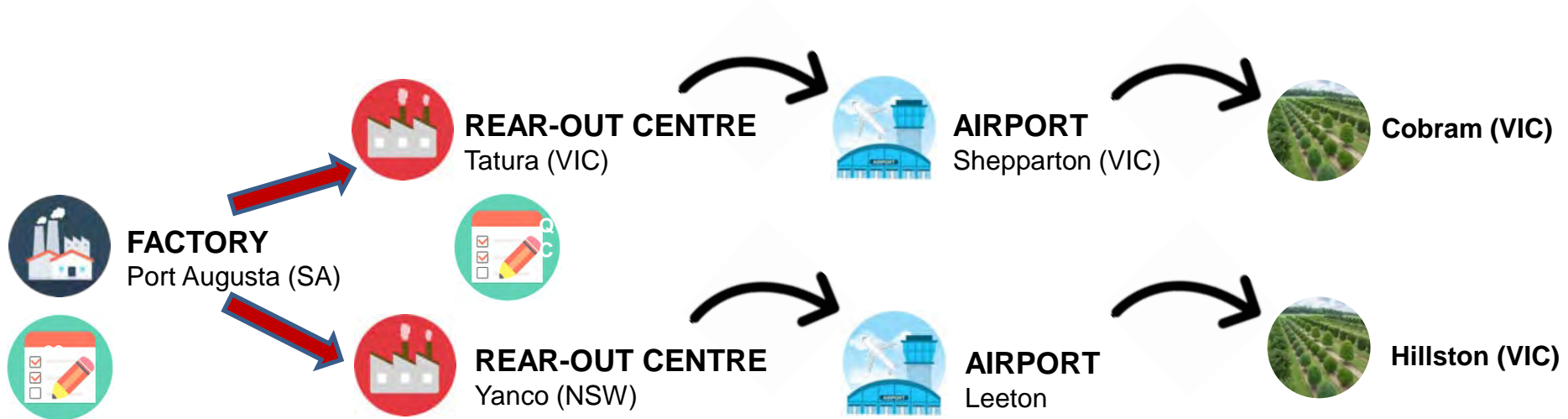
- Historically released at 2 -3 days
- Releasing at 5 days provides **>5 fold increase in recaptures**
- Massive benefits for overflooding and economy

SITplus now and to the future



- SIT factory built in Port Augusta
 - New R&D has been key
- Release operations under way in SA
- Research releases under way in VIC (Cobram) and NSW (Hillston)

'Post-Production Pilot'



Delivery

Port Augusta



Tatura (VIC) & Yanco (NSW)



Rear-Out



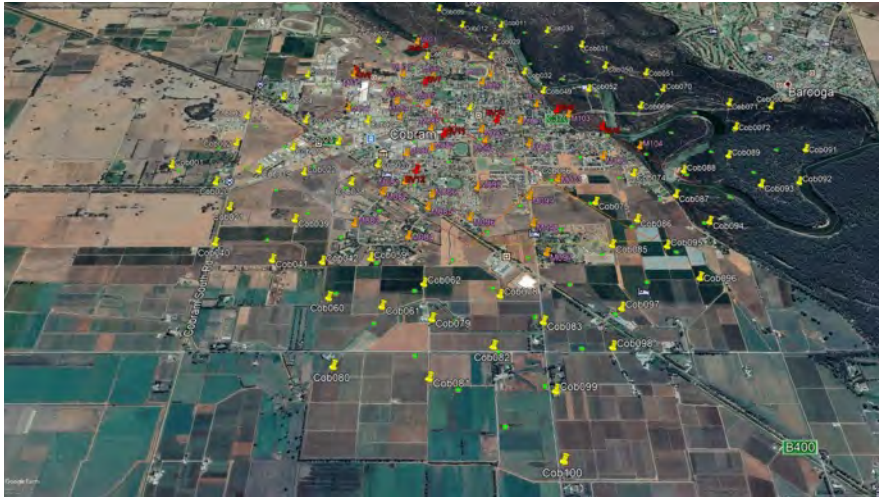
Knock Down



Loading for Release



Release sites



Cobram

Comparison site: Mooroopna



Hillston

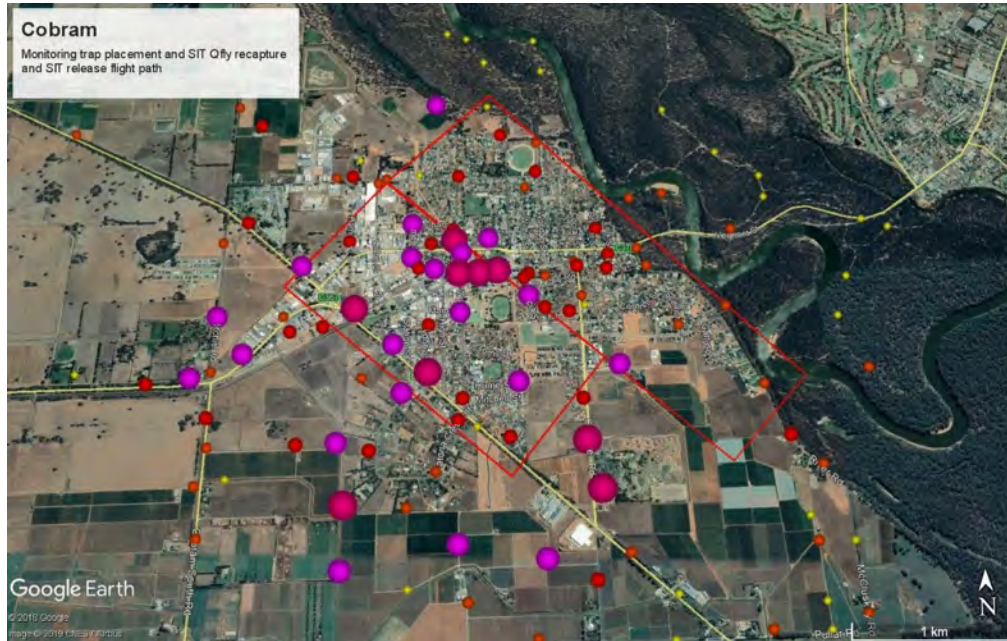
Comparison site: Lake Cargelligo

2019 / 2020 Releases

- The **first release** of sterile Qfly in **both sites** was on **11-12 September 2019**
- **32 weekly releases**
- 2 million flies released per week per site
- Flies captured inspected by **VICAg** and **NSW DPI**
- Data sent to **Plant and Food Research**, NZ for analysis
- Promising results in 2019/20 sterile Qfly season
- 2020/21 season under way!



High Recapture Rates, and Long Persistence



- Most recaptures in 3 km radius
- Two flies found 8.4 km away
- Much longer persistence than previous SIT
- Higher quality flies
- Longer pre-release holding



Questions?




MACQUARIE
University

SIT use in WA



Fruit Fly Eradication in W.A

• 1978-1985	Medfly	Carnarvon	Bait/SIT	 Permanent trapping grid installed
• 1989-1993	Qfly	Perth	Bait/SIT/MAT	
• 1995	Medfly	Kununurra	Bait/Strip/Cover spray	
• 1995	Qfly	Perth	Bait	
• 1997	Medfly	Kununurra	Bait/Cover	
• 1999-2000	Medfly	Broome (trial)	SIT	
• 2000	Medfly	Kununurra	Bait/Cover	
• 2003	Medfly	Katanning	trial – Bait/SIT	
• 2011	Qfly	Perth	Bait	
• 2015	Medfly	Kununurra	Bait	
• 2015-2019	Medfly	Carnarvon (trial)	Bait/Mass trapping/SIT	
• 2018/19	Qfly	Perth	Bait	
• 2019	Qfly	Perth	Bait	
• 2020	Qfly	Perth	Bait/SIT/MAT	



SIT in WA

- First applied in Carnarvon from 1980-1984
- Isolated area 1,000 km north of Perth
- Gammacell 220 Irradiator obtained from Canada
- Approximately 12 million fruit flies were produced each week (ground).



- Initially no insecticide used, but became necessary to knock down population
- Used baiting and cover sprays on 40% of area.
- Eradication based on finding no infestation of adults or larvae for a period equivalent to 3 fly generations according to a standard set by Hendrichs et al. (1982)
- Successfully eradicated – declared 1984
- No controls were in place to prevent reinfestation

WOMEN SEEKING MEN

Country girl seeks fertile male to start family urgently
no photos required.

PO BOX C00SIT
Carnarvon

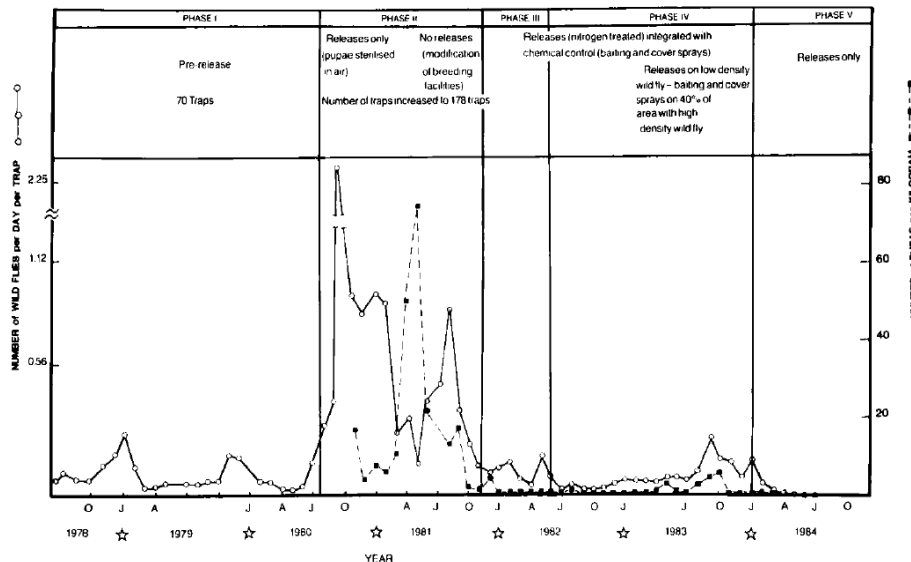
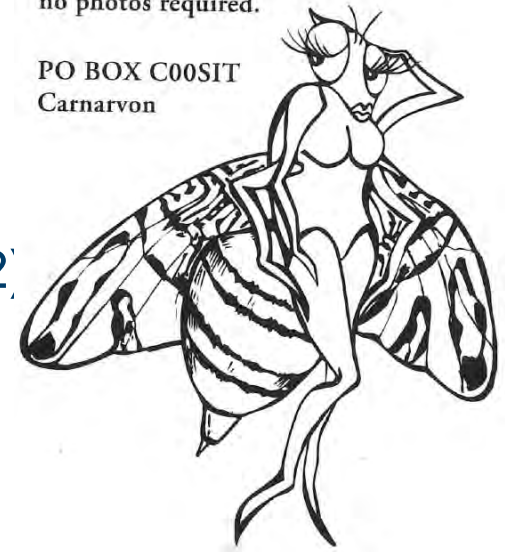


FIG. 1— The average number of wild Mediterranean fruit flies per trap per day and the average number of pupae per kilogram of fruit in Carnarvon each month from July 1978 to October 1984. A history of the eradication programme is shown.

J. Aust. ent. Soc. 1985, 24: 207-208

207

NOTE

ERADICATION OF *CERATITIS CAPITATA* (WIEDEMANN) (DIPTERA: TEPHRITIDAE) IN CARNARVON, WESTERN AUSTRALIA

K. T. FISHER, A. R. HILL and A. N. SPROUL

Department of Agriculture, Baron-Hay Court, South Perth, W.A. 6151.

Qfly - 1989

- Breeding population detected in Dalkeith in February 1989
- New rearing facility capable of producing 30 million sterile Qfly/week built over 3 months at a cost of \$500,000 (\$1,075,432; 'the esky')
- 300 km² – baiting and male annihilation technique
- 950 million flies released over 16 months
- 1991 – Qfly eradicated at cost of 8 million (\$17,206,912)

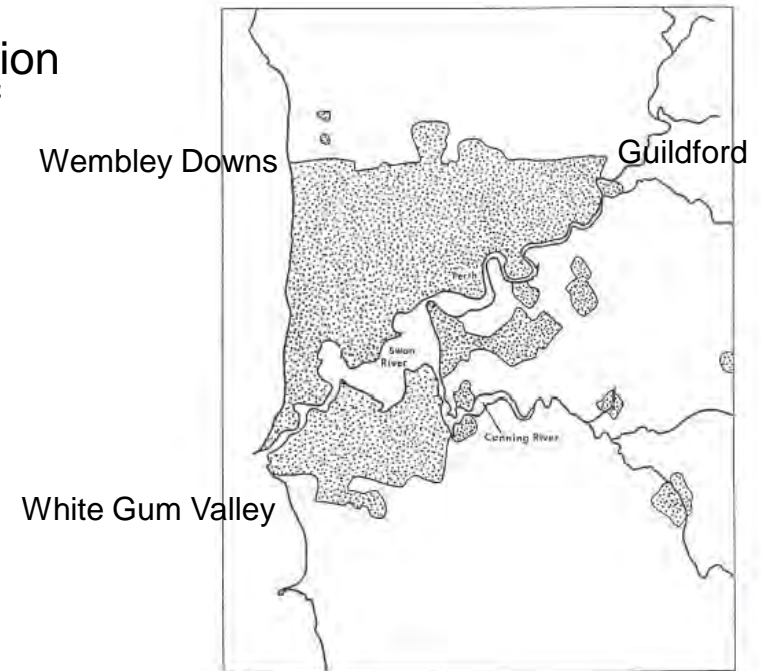


FIGURE 2.5
Extent of the foliage baiting operations.

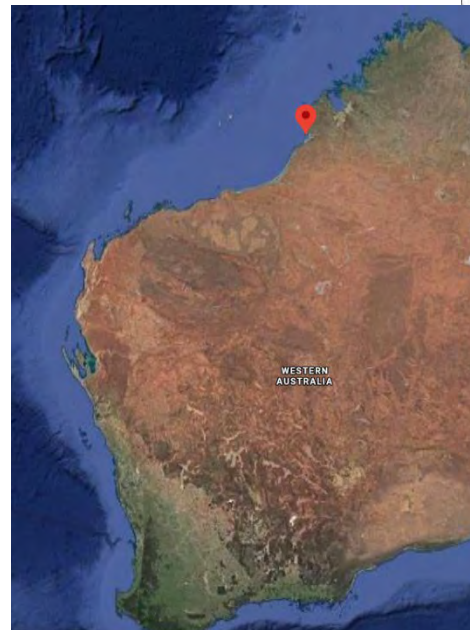
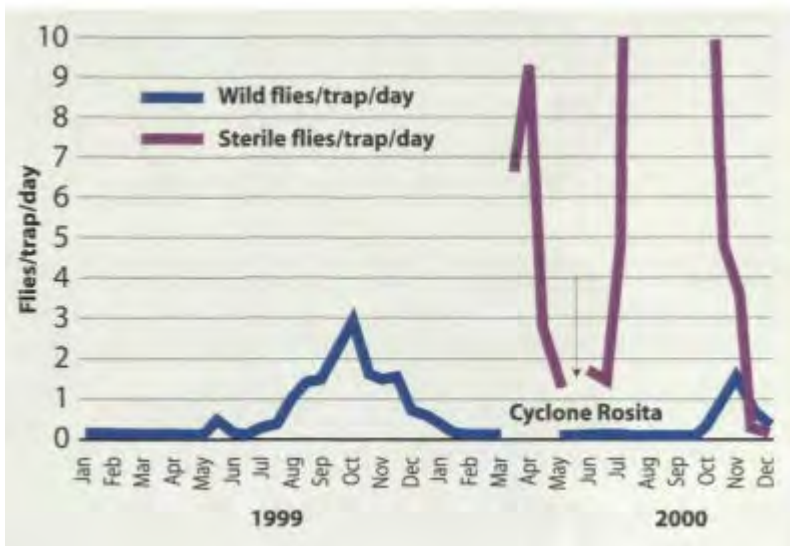
Renewed effort to eradicate Medfly

- 1996 – Minister for Primary Industry and CEO DAFWA visit Chile and Argentina
- 1997 – national workshop to consider eradication of Medfly from WA
- Pilot scheme to eradicate Medfly from the Kimberley
- 1999 - Medfly - TSL (Temperature Sensitive Lethal) strain imported in 1999 from Austria – female eggs die at 34 deg. C.



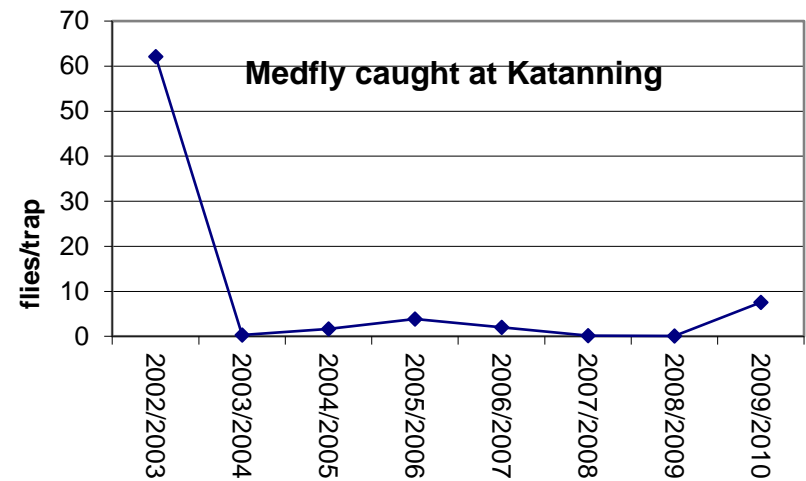
Broome 1997-2000

- Trapping throughout Kimberly to determine distribution of Medfly
- Only found in Broome
- Releases over 20 km² townsite and two horticultural areas
- No baiting, Cyclone Rosita



Katanning – 2003-2007
baiting/SIT
reduced population to low
levels

Perth Hills – 2015 Roleystone
(10 weeks)



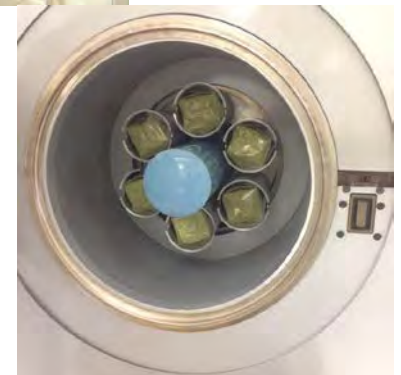
Carnarvon 2015-2019

- Royalties for Regions/HIA/Carnarvon Growers Association/DAFWA



South Australia

- Medfly were reared in South Perth to assist South Australian Eradication Programs from 2001 to 2013
- Up to 6 million flies/week
 - Millswood, Clarence Park, Malvern, Unley, Fullerton 2001
 - Salisbury 2002
 - Wingfield 2006
 - Ceduna 2008
 - South Brighton, Woodville North, Wingfield, Seaton 2010
 - Ethelton, Ottoway 2012
 - Sellicks Beach 2014
 - Clarence Park, Kurralta Park, Col. Light Park, Camden Park 2016.



Continued funding of the Medfly SIT facility

- Following the Carnarvon trial, WA has no current use for the SIT facility
 - Only country with Vienna 7 strain
 - Only Medfly SIT facility in Australia
- 2020-2021 – national funding for facility (maintenance) from most jurisdictions and DAWE
- Beneficiary analysis to determine which industries benefit the most from maintaining the ‘east-west’ distribution of Medfly
- Cost benefit analysis and technical feasibility of eradication of Medfly from Australia being considered

Thank you

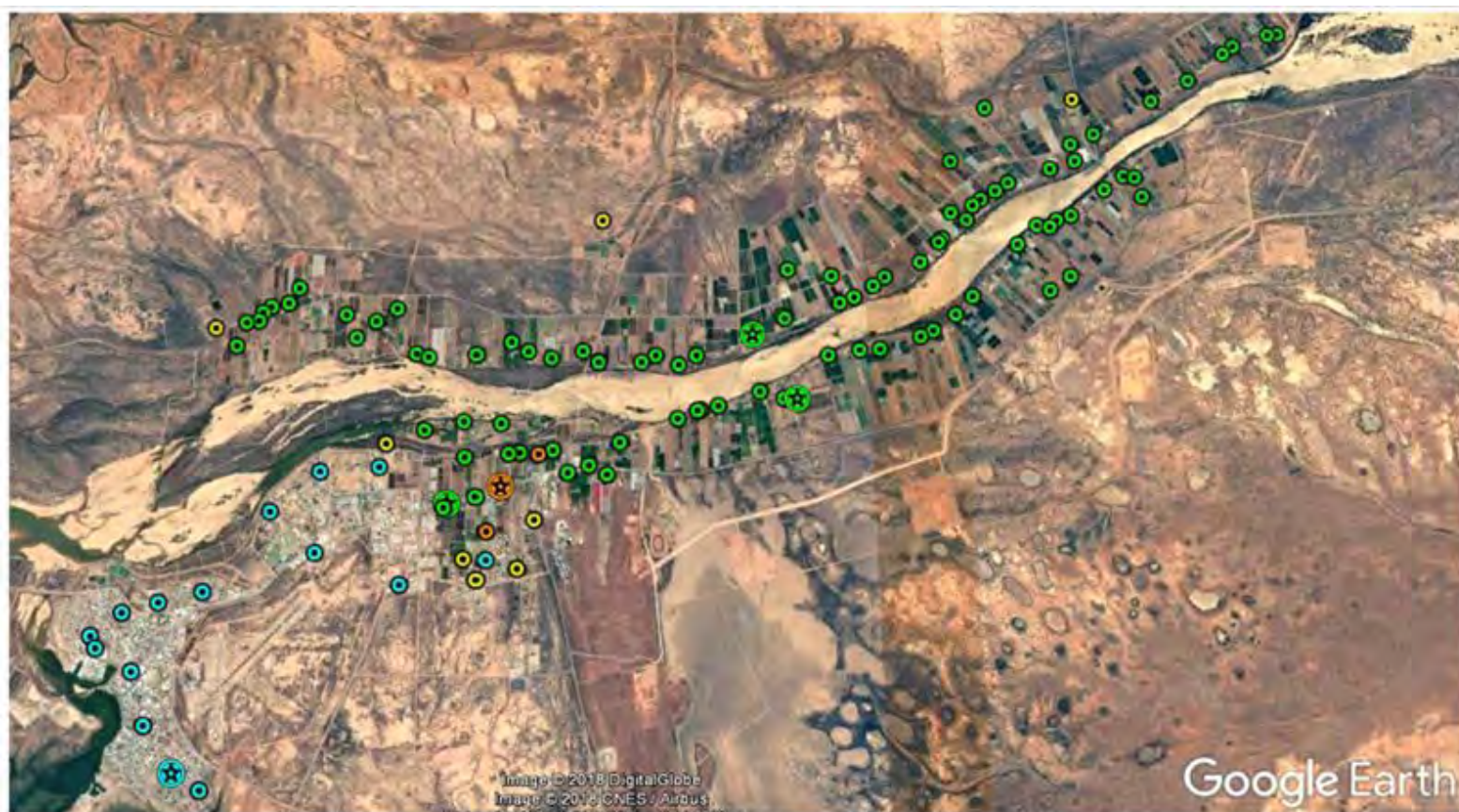


SIT experiences in Carnarvon 1981-84 & 2014-19

Compared and contrasted



Carnarvon is isolated with 189 plantations (approximately sized 5-35 ha) and 1857 residential properties. Originally settled in 1920s to supply vegetables in winter for Perth.



KEY

Site type

- Production area trap (n=94)
- Urban (n=15)
- High risk area / Point of entry (n=3)
- Marginal area (n=8)

Traps at site

- ⊛ Node – Medfly, Qfly and Oriental Fruit Fly Traps
- ⊙ Medfly Jackson Trap

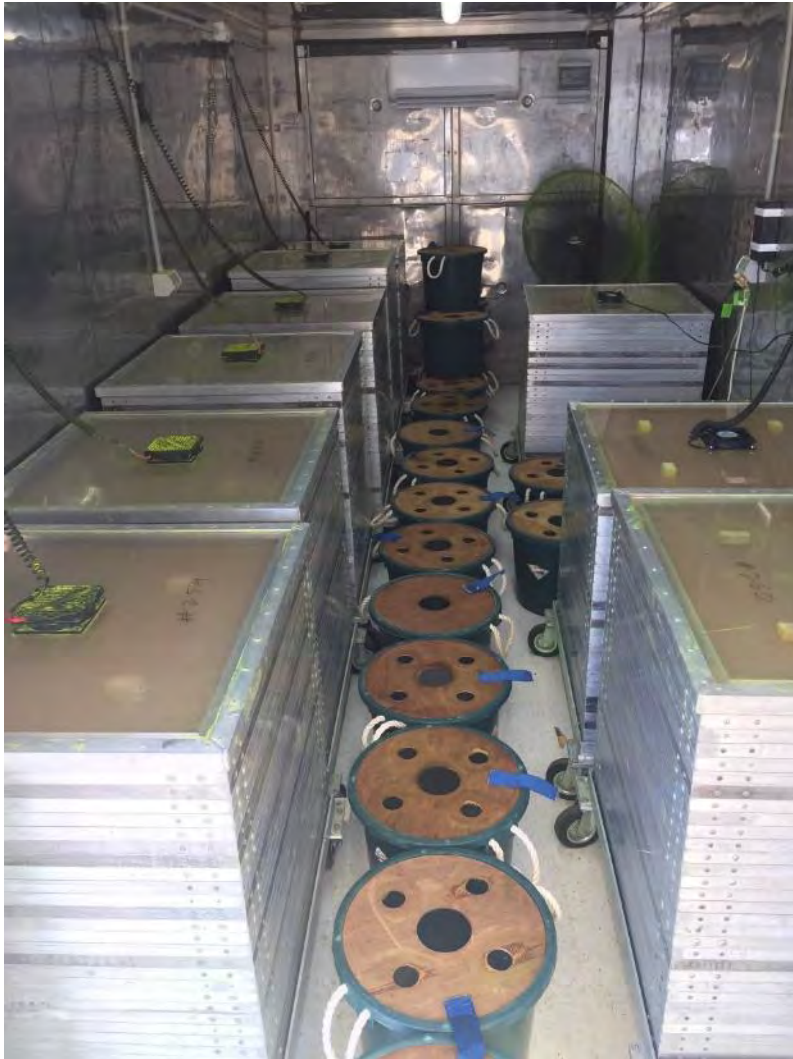
SIT trial

A pilot project trialing modern techniques to eradicate Medfly from Carnarvon was funded from August **2014- May 2019**. Techniques trialed included SIT, area wide foliar baiting of plantations, mass trapping in town and plantations, and plantation hygiene. The predicted benefits to Carnarvon growers include the potential to increase national and international market access, reduction in pesticide usage, and less fruit fly damaged and wasted produce. **Eradication has been estimated to create a net benefit of approximately \$17.1 million over 10 years, with a cost-benefit of \$3.80 created for every \$1.00 invested in eradication (Cook 2014).**

Custom facility



Sterile fly release facility built in Carnarvon



Opened March 2016 and first medfly releases mid 2016.



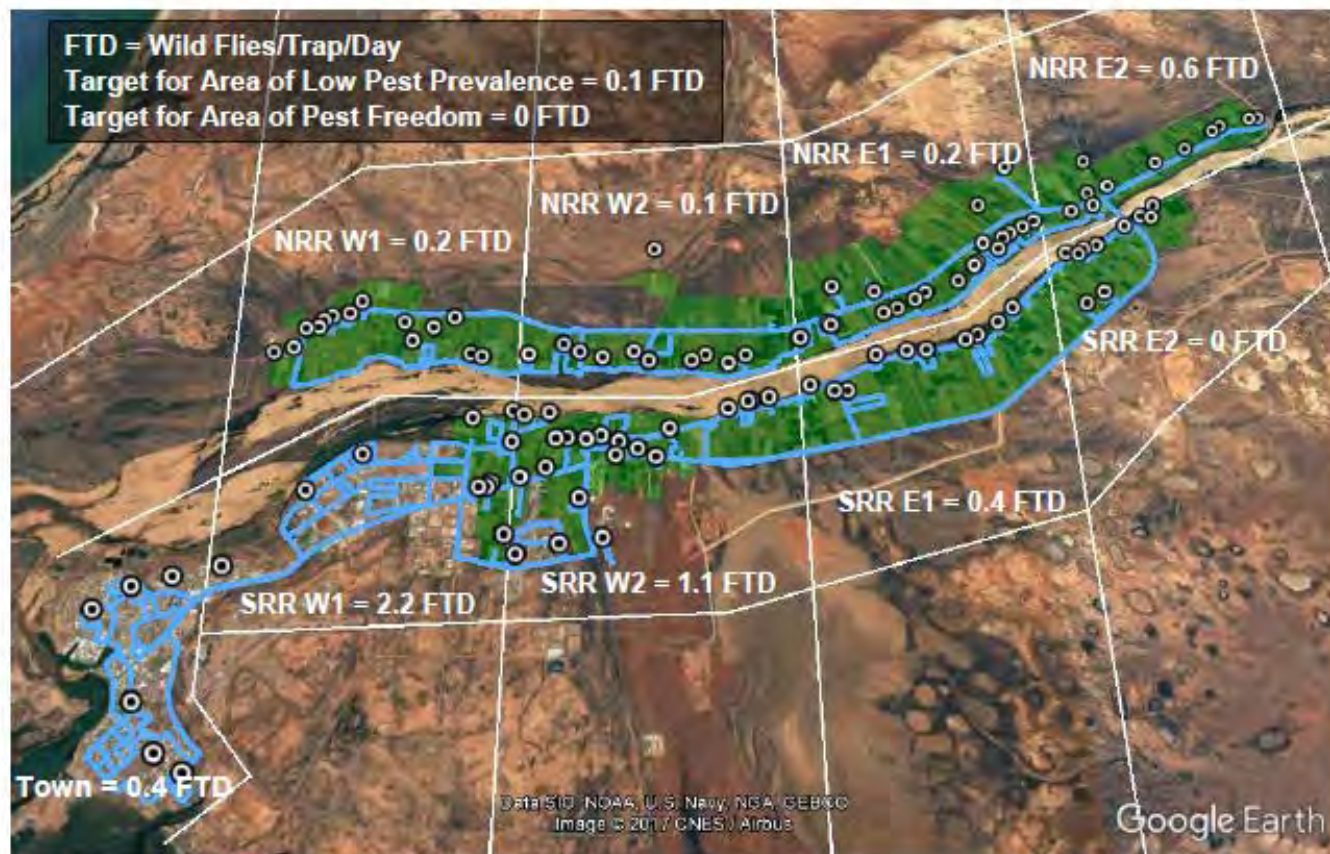
Sterile medfly release vehicle.

Medfly pupae in the Carnarvon emergence facility.



Department of
Primary Industries and
Regional Development

Carnarvon Medfly Pilot Eradication Project Current Wild Medfly Numbers



Horticulture
Innovation
Australia



Medfly
monitoring trap



Medfly fortnightly
baiting area*

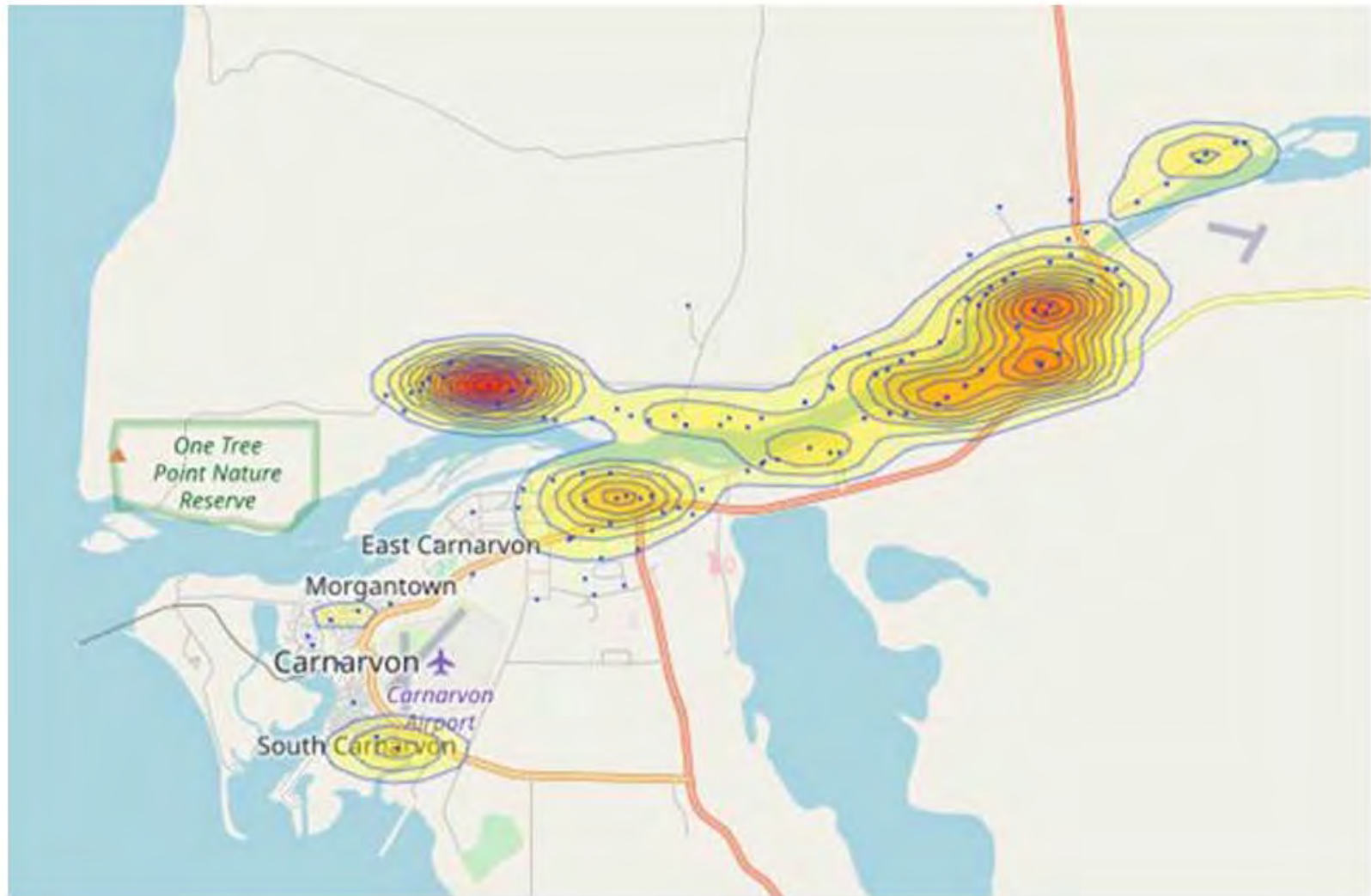


Sterile male Medfly
release route

*Dependant on weather
conditions and other factors

Supported by Royalties for Regions

Heat map



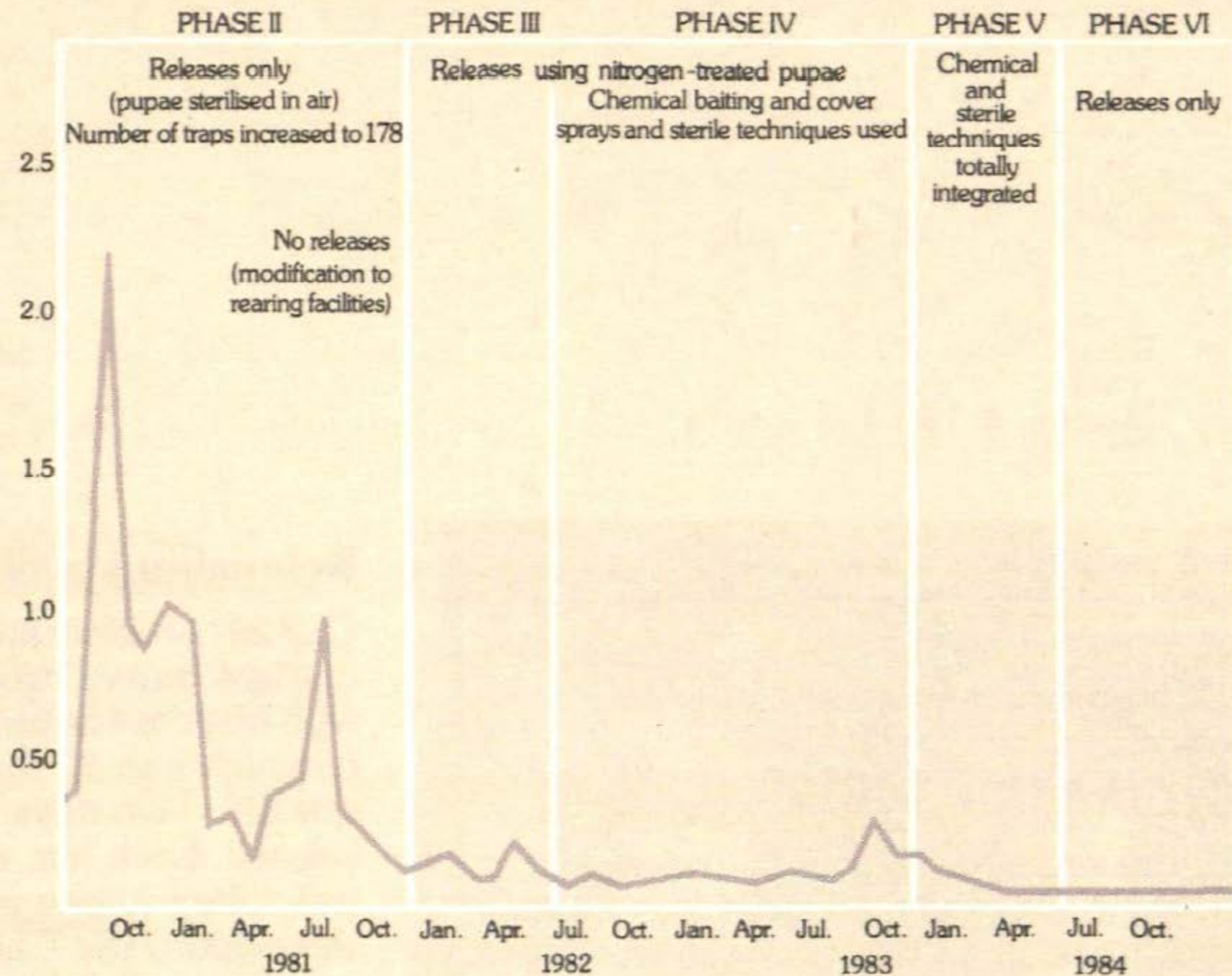
Hygiene!



Grower support



Number of wild fruit flies per trap per day.





Medfly Eradication Pilot project

has been underway in Carnarvon for **three years**
and fly numbers have been **significantly reduced**

^ mixture of trap * to-date

SIT compared and contrasted

	Carnarvon (1981 - 1984)	Carnarvon (2014 - 2019)	
Project aim	Eradication	Technology trialling	
Funding	WA government	WA Gov't/HIA/Growers	↑
Level of funding	adequate	inadequate	↓
Staff numbers	adequate	inadequate	↓
Community acceptance	Ambivalent	Polarised	↓
Politics	No	Yes	↓
Community engagement	Local identity	None initially	↓
Regulation used	No	Yes	
Crop hygiene issues	Seasonal	Major	↓
Cover sprays used	Yes	Yes	
Trapping systems	Male only	Male, female, MAT etc	↑
Baiting	Project based	Project based	

SIT compared and contrasted continued

	Carnarvon (1981 - 1984)	Carnarvon (2014 - 2019)	
Winter hosts	Mainly annuals	Annuals & perennials	↓
Summer hosts	perennials	Annuals & perennials	↓
Flies released	Male and female	Male only	↑
Computer systems/GIS	No	Yes	↑
Custom facility	No	Yes	↑
Release method	Buckets (manual)	Mainly automated	↑
Diet supplements	No	Yes (ginger oil)	↑
Grower involvement	None requested	Requested	↑
Grower group involvement	None requested	Involved	↑

The bottom line

Technology offers efficiencies in mass rearing, surveillance, fly release and cost per million flies, **however**

effective **baiting**, property **hygiene** & community **engagement**, are essential and grower **collaboration/stewardship** and managing local **politics** & developing an appropriate **funding model** are pivotal in delivering an agreed outcome.

Thank you

