

Final Report

SITplus Port Augusta Qfly SIT factory pilot operation (core services)

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Delivery partner:

Department of Primary Industries and Regions

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FF18003

Project:

SITplus: Port Augusta QFLY SIT factory pilot operation (core services) (FF18003)

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Public summary

The SITplus facility was officially opened in November 2016. Initial work focused on the development of sustainable and innovative production practices, to maximise the production capabilities of the factory. Modification of equipment developed overseas for rearing Med Fly and the development of completely new cages/towers has allowed the production process to be streamlined and to specifically suit Qfly. The key staff members in the facility now have experience which covers all aspects of the commercial production of Qfly, from day-to-day procedures to managing production teams, and have been active participants in the planning and expansion of the existing fruit fly culture in the facility.

The focus of the facility management is to refine existing standard operating procedures to ensure the highest possible number of fit for purpose, healthy Qfly are produced in the most financially economical way.

During the period of this project, the factory has been consistently produced up to 25 million sterile pupae per week (current facility maximum capacity), the some of which were dispatched to rear out centers in Yanco (NSW) and Tatura (VIC) for experimental release efforts, to Queensland Department of Agriculture and Fisheries to assess efficacy of IR colour pupal sorting equipment and to SARDI, Adelaide for Insecticidal bait efficacy trials. Many hundreds of millions of sterile flies were also dispatched to rear out centers in Netley and Renmark (SA) for use in outbreak responses in both metropolitan Adelaide and in the Riverland (SA), as well as to assist outbreak response in Perth, WA.

The eradication of Qflies has now been achieved in Perth WA, and Metropolitan Adelaide in 2021, largely due to multiple releases of sterile flies. Numerous Qfly outbreaks across the Riverland PFA since 2021 have required the ongoing use of SIT flies mainly via aerial releases. Such is the reliance of South Australia on the supply of sterile Qflies, that the current facility production area is being doubled, to meet both regional and federal fly requirements.

Introduction

Sterile Insect Control for Fruit Flies

Sterile Insect Technique (SIT) is a method of pest control using area-wide releases of sterile insects to reduce reproduction in a wild population of the same species. It is used with other techniques such as protein baiting and orchard hygiene to create fruit fly free areas, or areas of low pest prevalence. SIT is currently being used effectively against fruit flies in the USA, Mexico, Chile, Argentina, Peru, Israel, Jordan, Spain and South Africa.

SIT reduces the use of pesticides. It is very acceptable to export markets, which are increasingly focused on ecologically sustainable production techniques that reduce or eliminate pesticide residues.

The SITplus collaboration

SITplus is an R&D collaboration between several parties with interconnected interests in the development and uptake of science solutions for management of Queensland fruit fly, namely:

- Horticulture Innovation Australia Limited (Hort Innovation);
- Department of Primary Industries and Regions South Australia (PIRSA) and the South Australia Research and Development Institute (SARDI);
- Plant and Food Research Australia Pty Ltd (PFRA);
- Commonwealth Scientific and Industrial Research Organization (CSIRO);
- Department Primary Industry New South Wales (DPINSW); and
- Macquarie University (MU)
- Department of Primary Industries, Parks, Water and Environment, Tasmania (DPIPWE)

- University of Western Australia (WSU)

SITplus was announced on 7th November 2013 by the Premier of South Australia, Jay Wetherill. The announcement was supported by a Memorandum of Understanding signed by the parties. Under that Memorandum of Understanding, the parties agreed:

- To commit to the establishment of a SIT facility in Upper Spencer Gulf (the Facility) in South Australia and the development of a sterile male-only line of Qfly for commercial production and release in horticulture production areas for both eradication and maintenance of low pest prevalence status
- That the South Australian Government, through PIRSA would commit \$3 million to establish a fit-for-purpose facility in 2013-14/2014-15. The South Australian Government will own this Facility.
- Hort Innovation, PIRSA/SARDI, PFRA, CSIRO, NSW DPI, and MU will collaborate and invest to develop a sterile male-only line of Qfly for commercial production and develop technology and protocols to underpin area-wide control approaches, under a collaborative research and development agreement that commenced in 2014-15
- Intellectual Property (IP) and other matters pertaining to commercialisation of sterile Qfly technologies will be developed by the parties to the MOU under a separate collaborative research and development agreement.

The Key points regarding SITplus are as follows:

- SITplus is an inclusive, national R&D initiative which addresses clear industry need and will achieve impact.
- The SITplus Stakeholder Advisory Committee (SAC) comprises of representatives from each core research funding partner.
- The SITplus Technical Advisory Committee (TAC) is drawn from core partners, project leads (and other external advisors and stakeholders by invitation at specific times)
- Other research agencies/institutes are able to collaborate to achieve program aims
- Commercial delivery partners are being sought to deliver sterile fruit fly solution packages to growers and regions.
- SITplus supports and delivers key elements of the National Fruit Fly Strategy and the National Plant Biosecurity RD&E Strategy

The SIT facility in South Australia

As part of the SITplus Initiative, the South Australian Government, with support from the Australian Federal Government through Hort Innovation (project HG14035) constructed a SIT facility in Port August for commercial production of male-only sterile Qfly.

As initially proposed, the facility was used as a pilot to:

- Develop the best method for producing fit sterile male only Qfly pupae
- Develop cost-effective production processes for commercial production and release in horticulture production areas across Australia

- Prove the commercial case for Qfly SIT

The strategic co-investment under FF1500 funded operation of the Sterile Insect Technique (SIT) facility for Queensland fruit fly (Qfly) production at Port Augusta in South Australia over the period 2016 to 2019. Funds from this project purchased operating equipment for use in the factory and paid costs of operation of the facility for its first three years of operation. During the commercial phase of the project, production peaked at 25 million sterile pupae per week (including pupae required to maintain the facilities production colony).

A second stage to the project was necessitated by the delays in development of a male-only strain of fly for use in the factory, the ongoing requirement to supply flies for the associated research projects incorporated in project 17001 and to continue to fund core facility staff needed for the pilot operation of the SIT facility at Port Augusta, South Australia.

Funds from this project have paid salaried staff costs for operation of the facility for three years and a complimentary bid from Western Sydney University (WSU) has supplied the operational and casual staffing costs incurred at the facility.

A key component of this project has been to have staff who have operated the facility under FF15000, provide the managerial, administrative, and technical requirements for the facility to produce flies to support FF17001. Activities included egg production and harvesting, larval rearing, pupae dyeing and irradiation, procedural optimization and quality control, and oversight of the facility including human resource needs, financial management, upkeep, and procurement of supplies required for fly production.

Methodology

Construction of the SIT facility in Port Augusta was completed in September 2016. Operation of the facility is currently being administered by PIRSA, South Australia. The facility was officially opened on 18th November 2016.

This project has continued to fund core salaried staff for pilot operation of the Port Augusta Facility. The pilot operation has been conducted under the umbrella of Biosecurity South Australia. Nathan Rhodes, Executive Director Biosecurity SA has been the project leader and was supported initially by the SITplus Program Director, Dan Ryan. Operational costs have been covered by a complimentary project by Western Sydney University.

This agreement between PIRSA and WSU, regarding factory operation outlined PIRSA's role including:

- Day to day management and oversight of the factory
- Employment of contracted state government personnel as factory staff
- Ensure compliance of the factory with state and national regulations
- Manage site capital, operating and casual staffing costs and invoicing WSU to recover those specified in the agreement.

A governance committee comprising the SITplus Program Director Dan Ryan, The National SIT Facility Manager Terril Marais, HIA representative Greg Chandler, WSU representatives Dr Marcus Riegler and Ian Anderson were nominated to take responsibility for decision making regarding factory operations. The governance committee conducted bi-monthly meetings either in person, or via teleconferences. The advent of Covid in 2021 saw most subsequent meetings conducted online due to health precautions.

Outputs

The agreed Outputs of the Project and performance against those can be summarized as follows:

The supply of one manager, administrator and three technicians to oversee the operation of the facility. Full capacity output of the facility is up to 50-million sterile Qfly per week. Output during the project will be matched by demand and annual maintenance requirements.

- Staffing has been supplied as per the contract, which has enabled the production of a maximum of 20 million bi-sex strain Qfly per week. Research into the development of a single sex strain continues by research partners, but until such time as such a strain is developed, the maximum production capacity of the current facility remains at 20 million flies

Information from pilot operation will be incorporated into a business case for the SIT facility. Commercial-in-confidence accounts demonstrating the business case will be made available under confidentiality agreement to potential commercial partners.

- A Business Case for the use of the Sterile Insect Technique for managing Queensland fruit fly was drafted for Hort Innovation by RM Consulting in July 2021. That Business Case found that the facility would provide significant local and national economic benefits through protecting the Riverland Qfly PFA status, as well as reducing Qfly pest pressure in Victoria and New South Wales.
- A report was commissioned by Hort Innovation and completed by RM Consulting Pty Ltd in 2021 on a cost benefit analysis of the Sterile insect technique for Queensland fruit fly. That report showed that the use of sterile insect technique (SIT) to preserve the Riverland PFA provides a net benefit of \$66m (net present value). SIT releases in Victorian and NSW towns is not viable, but a modified version may be worthwhile. Using SIT to reclaim Pest Free Area (PFA) status in Victoria and New South Wales is not viable.
- A Benefit Cost Analysis was completed for sterile male fruit fly research which considered the Net Present Value of the development and production of a male only selecting, temperature sensitive lethal, strain of Queensland fruit fly. That works estimates a Net Present Value of full adoption of the approach in 20-years time of \$5.7M and compares that to 50% adoption (NPV of \$2.9M) and 25% adoption (NPV of \$1.5M).
- An economic evaluation of the Sterile Insect Technique (SIT) for the control of Queensland fruit fly with a particular focus on its use as preventative (prophylactic) technique in a Pest Free Area was completed by Donald S Shepard, PhD, FASTM, Fulbright Distinguished Chair. That works suggested that the adaptive prophylactic use of SIT was likely highly favorable with an estimated benefit-cost ratio of 5.3 to 1 (noting that the prophylactic use of SIT in a Pest Free Area is currently not recognized under Australia's National Fruit Fly Management Protocol).

Six monthly reports and a final report will be provided to Hort Innovation

- Milestone reports have been submitted and accepted by Hort Innovation as per the reporting schedule listed in the contract.

Additionally, the primary outputs of the project are development and refinement of factory SOPs and production of sterile flies for a range of applications, including outbreak response, area wide management and buffering around the Riverland Pest Free Area. A full list of SOPs was provided in with the final report of FF1500.

Outcomes

The agreed project outcome was commercially viable SIT for use across South Australia as part of increased adoption of integrated pest management to reduce the impact of Qfly on production and underpin trade.

The factory continues to use an established bi-sex strain and has a consistent production run of approximately 20 million pupae per week. That work is currently supporting a significant eradication response in South Australia under a cost-recovery model which has seen several hundred million of sterile Qflies supplied and release into the SA Riverland. As a result, the South Australian government is currently the only commercial partner committed to the ongoing maintenance costs of the facility, but negotiations continue at the national level to explain the benefits of Qfly SIT to the national fruit fly system, including in protecting over \$800M in annual trade.

The facility continues to show the value that sterile Qfly can provide to the largest fruit fly eradication program ever attempted in Australia. Both static and ground releases of sterile flies have been used through 2019 – 2023 to assist with the eradication of Qfly outbreaks across regional South Australia (Riverland PFA) Metro Adelaide, and Perth WA.

SOPs have continued to be refined to guide factory procedures and protocols and staff have been trained in their implementation, to ensure consistently optimized Qfly production, quality, and fitness. These have been reviewed and approved by the Manager, National SITplus Facility and General Manager, Plant and Food Standards (PIRSA). The factory and staff have the capacity to accommodate a male only strain once it has been developed. Staff also have the technical expertise to be able to develop new procedures and adapt current SOPs to suit male only production.

Monitoring and evaluation

The delivery of core services has been monitored and evaluated based on delivery to budget, meeting delivery of needed sterile pupae and adherence to quality parameters.

- The facility has continued to operate within the approved budget with demand for sterile pupae being supplied to meet requirements for the supply of flies to meet WA and Metro Adelaide eradication requirements 2021, research requirements for area wide management trials in Yanco and Tatura, IR colour sorting trials at QDAF, pesticide and lure efficacy trials by SARDI.
- Detailed documentation has been developed and maintained for all quality control aspects of Qfly production as per IAEA guidelines. In addition to this, temperature and humidity logging has occurred during all phases of transportation to all rear out centers. As well as the recording of temperature and humidity of pupae during transportation to rear out sites, the humidity and temperature of pupal batches delivered to the Riverland is recorded during emergence, transport, loading and aerial releases over the Riverland. Quality control results gained from rear out staff is compared with factory quality control results to determine if any problems have arisen during transport that could affect the quality of flies once they leave the factory. Data logger results along with quality control results from both the factory and rear out centers have been recorded on the Hort Innovations Delivery Partner Portal.

Industry level

Support for SIT and willingness to invest – Industry awareness and support for SIT has been substantially raised through the project. An indicator for this has been strong industry support for SIT releases across the current Riverland outbreaks and the provision of a grant of \$50,000 provided by Citrus SA to be invested in the planned expansion of the existing facility. Industry has also expressed strong support for area wide management and prophylactic use of SIT, once any market access concerns have been addressed through development of the relevant sections of the National Fruit Fly Management Protocols.

Capacity and practice change

Full staff complement hired and trained – The factory is operating at required capacity and a full complement of technical, operational, management and administrative staff are in place.

Equipment installed in factory – All required equipment is now installed in the factory and operational. This includes larval towers, breeding cages, sifting, and dyeing equipment, washing facilities and 2 irradiators.

SOPs in use – SOPs have continued to be refined and are in use. An ongoing training and compliance program is in place to ensure application of and adherence to SOPs by all staff (copies supplied with final report for FF1500).

Sterile flies from the facility have continued to be successfully deployed in a range of real-world situations including population suppression, buffering pest free areas from pest pressure, and eradication of outbreaks. This demonstrates the factory can produce sterile flies of sufficient number and quality for successful practical application.

Recommendations

- The project has demonstrated that sterile Qfly are able to be produced on a commercial scale to a high quality such that they are able to substantially support large-scale eradication and suppression programs for the pest.
- The project has demonstrated the willingness of Industry groups to support the continued use of sterile fly releases across outbreak areas albeit without ongoing financial contributions to date.
- The use of aerially released sterile flies has provided strong evidence that it is possible to reduce fruit fly numbers and, in some circumstances, eradicate Qfly in urban and peri urban areas which can often prove difficult for ground staff to access
- The existing facilities production capacity (20 million flies per week) is insufficient to provide adequate numbers of sterile flies to meet the current requirements of regional South Australian outbreaks as well as research/control requirements interstate, necessitating the expansion of the current facility to enable the production of an additional

20 million flies per week.

- Lessons learned during the practical use of the pilot facility building since it's opening in November 2016, have enabled refinements in ergonomic use of space and equipment to be incorporated within the design of the proposed extension. Completion of this extension is expected to be achieved by the end of July 2023, enabling the use of increased numbers of sterile flies to be used in the Spring eradication program in the Riverland PFA area.

Intellectual property

No project IP or commercialisation to report.