Integrated waste management strategies to minimise the risk of transportation of the Little Fire Ant (*Wasmannia auropunctata)* in Tahiti, French Polynesia

A report to the Secretariat of the Pacific Regional Environment Programme, supported with funding provided by *Fonds Pacifique*
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Executive Summary

The electric ant or little fire ant, Wasmannia auropunctata*, is a small ant native to Central and South America which has been introduced into seven Pacific Island groups. It is considered to be the greatest ant species threat within the Pacific Region. Although its official discovery in Tahiti was in 2004, it is likely that the little fire ant has been present in Tahiti for much longer. The centre of contamination in Tahiti is the northern Mahina Commune. Initial treatment and monitoring initiatives to combat the ant invasion were carried out between 2005 and 2009, but were discontinued in 2010.*

Little fire ants are known to infest green waste as well as oversized waste left out for collection. To counter human assisted transportation of little fire ants, the movement of green and oversize waste from the Mahina Commune to other areas of Tahiti was prohibited in 2006. However, this ban has hindered effective waste management in the Mahina Commune, and resulted in adverse environmental impacts from the continued use of an unregulated dumpsite used to temporarily dispose green waste and oversize waste.

Green waste from the Mahina Commune could be composted under controlled conditions at a local site to minimise or eliminate any accidental ant transportation. Composting green wastes under controlled conditions elevates internal compost temperatures above 60^{o}C for a sufficiently long duration to kill any insect pests (including Wasmannia*) in the composting vegetation. Strict adherence to routine quality assurance measures at the composting site including ant baiting and monitoring, compost pile temperature logging, adherence to minimum compost row separation, use of soil pesticide barriers, runoff monitoring and regular sterilization of all machinery and tools involved in composting operations would ensure that the ant was not accidentally transported in final compost products.*

Collected metallic oversize waste to be exported overseas for recycling also present a potential source of ant contamination and transport. Oversized waste collected from elsewhere in Tahiti are currently compacted and then fumigated with methyl bromide to kill any pest species (including the little fire ant) prior to export. Arrangements to also treat oversized waste collected from Mahina with the fumigant should be investigated. In parallel, controlled trials should be undertaken to assess the efficacy of heat sterilization achieved through long-term sunlight exposure on metal shipping containers and their contents as an alternative to continued use of methyl bromide fumigation of compacted, oversized waste.

All compost produced in Tahiti is also currently fumigated with methyl bromide prior to sale. The necessity for this should be reviewed, and a public education campaign developed to explain any changes to ant control measures and to help market the Mahina compost product.

An assessment of any legislative changes required for improved green waste and oversized waste management in Tahiti should also be completed, and funding sought for the remediation of the Mahina unauthorised dumpsite following its closure.

1. Background

1.1. The Little Fire Ant

The electric ant or little fire ant (*Wasmannia auropunctata)*, is a small, forest dwelling ant native to Central and South America (Figure 1). It has been introduced to parts of Africa, North America and into seven Pacific Island groups (including the Galápagos Islands, Guam, Hawaii, New Caledonia, Vanuatu, Tahiti and the Solomon Islands) and to north-eastern Australia (Wetterer and Porter 2003). Where it is introduced, the ant is blamed for reducing species diversity, reducing overall abundance of flying and tree-dwelling insects, and eliminating arachnid populations. It is also known for its painful stings. It causes severe direct impacts on humans by reaching high densities in settlements, farmland and natural habitats, and poses significant risks to the environment and economies of trading and transport partners if introduced (Fernald 1947, Fabres and Brown 1978, Delabie 1995). The little fire ant is considered to be the greatest ant species threat within the Pacific Region.

1.2. The Tahitian Problem

Although its official discovery in Tahiti was in 2004, the little fire ant is likely to have been present at least 10 years earlier. The centre of contamination in Tahiti is the Mahina Commune (Figure 2). A major introduction route of the little fire ant can be through the movement of green waste and plant material. Controlling green waste and plant movements to minimize the spread of the ants is therefore a critical, albeit very difficult community management issue connected with management of the little fire ant. The importance of this problem was recognized in 2012 by the funding body *Fonds Pacifique* (The Pacific Fund). The fund allocated a €120,000 grant to SPREP and the Mahina Commune to develop strategies to improve waste management practices to minimize the ant's spread through the movement of green waste. Additional work under the grant will develop model ant bio-security strategies to improve invasive species management in French Polynesia, as well as for the Pacific more generally.

Figure 1. The little fire ant (*Wasmannia auropunctata). ©David Haynes*

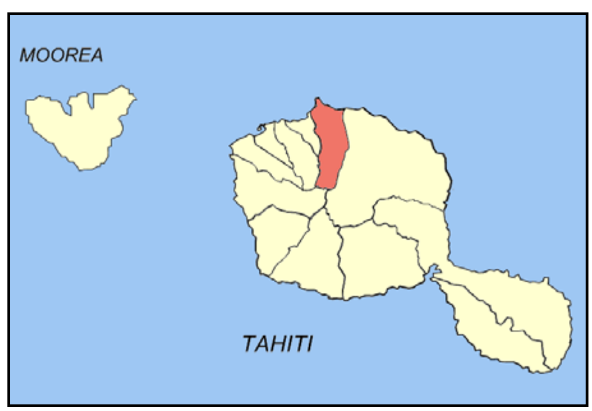

Figure 2. Location of Mahina Commune on the island of Tahiti, French Polynesia.

2. Introduction

2.1. Little fire ants in Tahiti

Little fire ants have been introduced into a number of Pacific countries including French Polynesia, Guam, Hawaii, New Caledonia, Papua New Guinea, the Solomon Islands, Vanuatu and Wallis and Futuna (Vanderwoude 2013). The invasive ants were first detected in the Tahiti commune of Mahina in July 2004, although the first infestation may have been present for as long as ten years prior to its discovery (Vanderwoude, 2013). Genetic studies suggest that the source population for the Tahiti infestation was located in New Caledonia (Foucaud *et al.* 2010). Initial treatment and monitoring initiatives to combat the ant invasion of Tahiti were carried out between 2005 and 2009, but were discontinued in 2010. Ten communes had recorded ant infestations by 2012, with the Mahina Commune having the largest number and extent of infestation. An increase in the area of little fire ant infestation occurs through the expansion of colonies, and while actual estimates are not available, the rate of this type of spread is typically slow, and measured in tens to hundreds of meters per year. In contrast, dispersal via human transport enables rapid colonization of new uninfected sites, and dispersal from one infested site to another can occur rapidly and over large distances (Vanderwoude 2013). With time, and in the absence of concerted control and containment activities, the extent of little fire ant infestation will almost certainly increase in Tahiti.

2.2. The Mahina Commune

The Mahina Commune is the fifth largest in French Polynesia, with a population of around 14,500 (2007). It is located on the northern side of the island of Tahiti and contains over 60 % of all Tahitian little fire ant infestations. These are believed to be contained in the area south of the main connecting road between municipalities, which has provided a barrier to ant movement. Infestations are believed to occur across 9% of the total Mahina land area, and a majority of infested sites are located near areas of human habitation. A major vector for ant movement is via the transportation of green and oversized (bulky) waste, and to counter this, a prohibition has been placed on the movement of these waste types from the infested Mahina Commune to other un-infected areas of Tahiti. This ban is compromising efficient and cost effective rubbish disposal in Mahina Commune, and is likely to be contributing to impacts from the continued use of an unregulated dumpsite for local green and oversized waste disposal.

3. Waste collection

3.1. Current waste collection and transfer services in the Mahina Commune

Responsibility for household waste collection services lies with the Mahina municipality (Table 1). Households in the Mahina Commune are required to separate wastes into ‘recyclable’ and ‘non-recyclable’ bins prior to collection (Figure 3), and green waste and oversized waste is placed separately in uncontained heaps on the roadway for collection (Figure 4). Estimates of the daily volume of waste produced by the Mahina Commune are $60m^3$ per day for recyclable waste, and $90m^3$ per day for other waste. Household rubbish is collected and transported to the *Sociètè Environmental Polynèsien* (SEP) Centre for Recycling and Transfer (CRT) in Papeete, where it is consolidated and transferred to the Poihoro Sanitary Landfill in larger trucks for final disposal. Recyclable waste from Mahina Commune is also collected and transported to the CRT for sorting, baling, and export to recycling markets in Asia and New Zealand. In the near future, domestic rubbish (excluding green and oversized waste) collected from Mahina households will be taken to a new Mahina transfer station (which is currently under construction). Collected rubbish will be transferred into large bins with $20m^3$ and $30m^3$ capacities prior to transport to the Poihoro Sanitary Landfill for final disposal. No little fire ants have been detected within this new Mahina transfer station site (Vanderwoude 2013).

Table 1. Summary of Mahina waste collection services, 2013.

Wastes	Collection Frequency	Responsibility
Recyclable waste (including aluminium and tin cans, plastic bottles, Tetra Pak cartons, newspapers and cardboard)	Once per week	Mahina Municipality
Non-recyclable waste	Twice per week	Mahina Municipality
Oversized bulky waste	Once per month	Mahina Municipality
Green waste	Twice per month	Mahina Municipality
Glass bottles (via public drop boxes)	As needed	Mahina Municipality

Figure 3. Household rubbish and recyclable bins, Mahina.
©David Haynes

Figure 4. Household green waste, Mahina
©David Haynes

Figure 5. Unauthorised green-waste dumpsite, Mahina.
©David Haynes

Figure 6. Mobile scrap metal compactor, CRT centre.
©David Haynes

3.2. Current waste disposal in the Mahina Commune

3.2.1 Oversized (bulky) waste disposal

Oversized (bulky) waste from Mahina residences are placed on the roadway for monthly collection. Due to the potential for contamination of this type of rubbish by little fire ants, a ban has been imposed by the *Direction régionale de l'Environnement* (DIREN) on its movement out of little fire ant infested areas. Consequently, oversized wastes have been dumped at an unauthorized Mahina dumpsite since 2006 (Figure 5). In contrast, a scrap metal compactor is relocated to other Tahitian communes by SEP to crush end-of-life vehicles and other oversized wastes prior to export to New Zealand on an as needs basis (Figure 6). The cost of metal recycling from these other communes is recovered from the import duty placed on all consumer goods (2%), and from the proceeds from the sale of the exported scrap metal.

3.2.2. Green waste disposal

Green waste from Mahina cannot be taken to a national composting facility in Poihoro and operated by Technival (see Section 4.1) due to a ban imposed by the DIREN on the movement of vegetation out of little fire ant infested areas. Consequently, green waste from Mahina Commune is currently collected twice per month from Mahina residences, and has been dumped at a local unauthorized site since 2006 (Figure 5). The unauthorized dumpsite covers an area of approximately 0.55 hectares (1.35 acres). There is some attempt at segregation of waste at the dumpsite, with green waste dumped on the eastern edges of the site, and oversized items on the western side. Illegal and uncontrolled dumping of household waste also occurs at this site, creating a mixed stream of rubbish at the dumpsite. Leachate runoff from the site is also unmanaged and presents a potential risk to adjacent waterways. As the dumpsite land has been committed specifically for a public cemetery, relocation of the dumped waste and rehabilitation of the site is of high importance. It has been suggested that little fire ant colonies may not have yet established at the site because of their sensitivity to the site's exposed, sunny conditions (Vanderwoude 2013).

3.3. Current green waste collection and disposal in other communes

Household waste from at least three Tahitian municipalities (Papeete, Pirae, and Arue) are collected door-to-door and transported for processing at the CRT in Papeete (Figure 7). Green waste is not accepted at the CRT. Green waste is collected from Tahitian municipalities (except Mahina Commune) by Technival for compost production. Following household collection, this green waste is reduced down to 80mm pieces in a mobile hammer mill chipper to minimize transport costs (Figure 8). The crushed green waste is then transported 50 kilometres in 30 m^3 bins to the Technival composting facility in Poihoro. Approximately 12,000 tonnes (50,000 – 60,000 m^3) of green waste is collected by Technival and processed annually at the Poihoro composting facility (Figure 9).

Figure 7. Papeete CRT waste transfer station.
©David Haynes

Figure 8. Technival Composting Facility green waste chipper.
©Technival

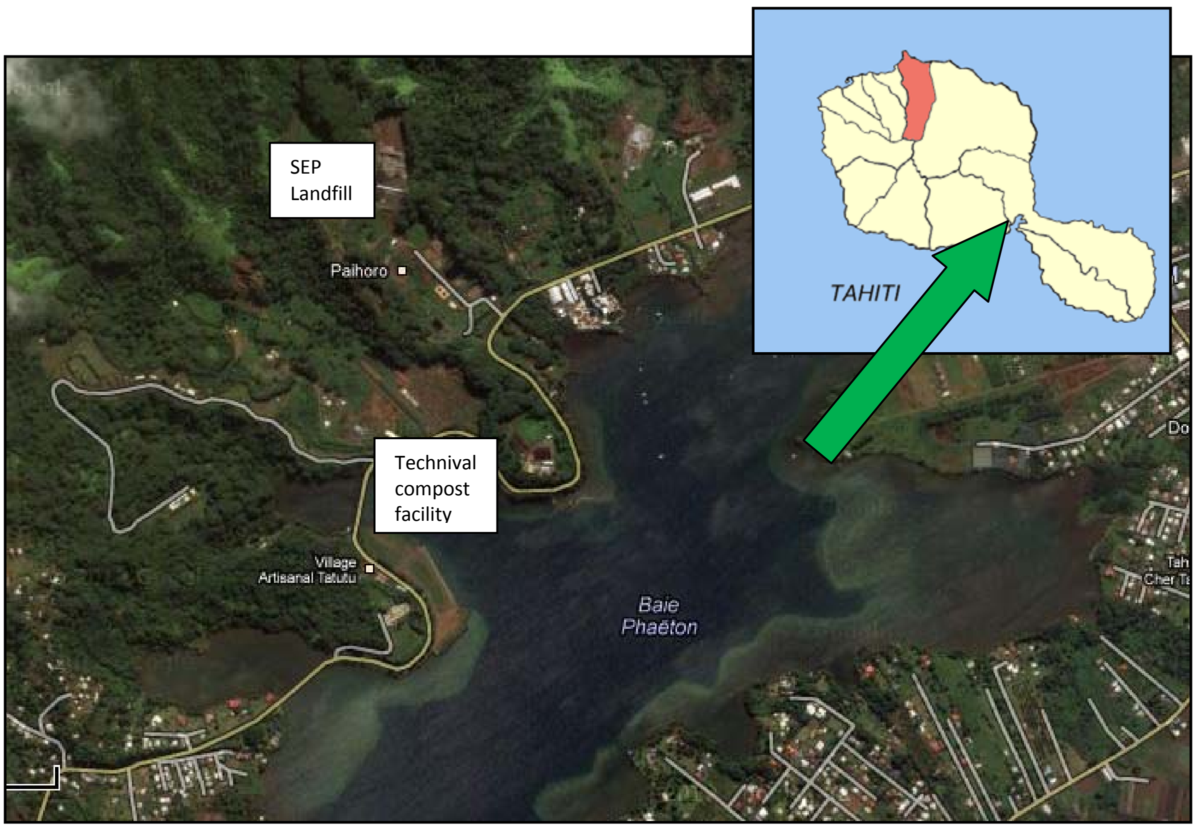

Figure 9.Paihoro SEP landfill and Technival composting facility *©Google Maps*

4. *Green waste composting*

Compost is organic (green) matter that has been decomposed and used as a fertilizer and soil improver. The decomposition of organic matter to form compost is aided by shredding the plant matter, maintaining an optimal moisture level, and ensuring proper aeration (usually by regularly turning the mixture). Micro-organisms, including fungi and bacteria break down the organic material in a process that releases heat and carbon dioxide, as well as nitrites and nitrates via nitrification.

4.1. *The Technival composting facility*

The Technival composting facility encompasses a total area of 5 hectares of a site at the southern end of Tahiti in Poihoro (Figure 9). The ground surface used for the composting process is impervious (it is about 80% waterproof), and covers an area of 8,000 m^2 of bitumen overlaid with liquid cement. The composting surface is currently being expanded by 5,000 m^2 to accommodate co-composting of sewage sludge and green waste.

4.2. The Technival composting process

Green waste is placed into open piles for 6-8 months at the Technival composting facility (Figure 10). During the first few months, piles are turned every 3 weeks using a loader, achieving temperatures in excess of 65°C for 3 days or more (as measured using manual temperature probes). During the maturation phase, two piles are combined and turned once every 2 months until fully composted. Composting procedures at the facility are believed to comply with EU compost hygiene standards (i.e. compost temperature consistently greater than 65^{o}C for at least 5 days; >60^{o}C for at least 7 days; or >55^{o}C for at least 14 days). Sewage sludge containing 30% total solids is also co-composted with green waste at the site. Prior to composting, collected sewage sludge is stored in Papeete for approximately 1 week, during which time core temperature reaches 85°C, before transportation to the Technival Poihoro composting facility. The piles of sewage sludge are mixed with green waste at Poihoro and covered with a green breathable waterproof textile to regulate moisture. The piles are forcibly aerated, and are turned every 3 weeks. Under these conditions, core pile temperatures reach over 80°C, over 70°C, and between 60-65°C after the first three turnings respectively. Mature compost can be prepared in only 3 months using a green waste and sewage sludge mixture through this process. The compost produced from green waste and sewage sludge is used only for "professional" activities such as grass production and in nurseries. This compost is not distributed to the public or used in production of food crops.

4.3. Compost sterilisation

The bulk compost destined for use in Tahiti is currently required to be treated with methyl bromide, and this sterilisation is performed as a free service provided by the Department of Agriculture at the Papeete port precinct (Section 5.5).

4.4. Compost product usage

About 50-60% of the finished compost produced by Technival from green waste is sold in bulk, usually in 1m^3 bags at the rate of XPF 9,000 (US$98) per tonne. The remaining product is sold as "organic compost" or mixed with peat moss imported from Canada, and with pumice and chemical fertiliser from New Zealand, to make a special potting mix sold at XPF 800 (US$9) per bag (Figure 11). Approximately 60% of Technival's income is derived from invoicing the municipalities for the collection and removal of green waste, and 40% comes from the sale of the compost and potting mix.

Figure 10. Compost windrow, Poihoro. ©David Haynes

Figure 11. Technival retail compost bags. ©David Haynes

5. Recommendations for improved green waste management in Mahina Commune

While there is very little information on the fate of little fire ants in active compost heaps, International quarantine requirements operate on the premise that insects cannot survive elevated temperatures (i.e. greater than 55 °C) for extended time periods (such as those attained in well-operated compost windrows). The recommendations for green waste management in Mahina Commune therefore centre on the optimization and careful management of the green waste composting process to eliminate the little fire ant through temperature elevation. This will allow the green waste from Mahina and other ant-infected areas to be used productively without risk of spreading the invasive species through green waste management.

5.1. Identification of a Mahina green waste composting site

Technival has the additional capacity and is prepared to treat green waste collected from Mahina Commune. It is estimated that green waste sourced from Mahina would account for an annual additional 3,000 tonnes or 15,000m^3 of raw material that could be composted. This is 25% of the current production capacity. Technival would prefer to compost potentially ant infested green waste from Mahina in Mahina, to maintain a separation of operation from Technival's current little fire ant free composting facility at Poihoro. This would preserve the good image, reputation, and public good-will built up by Technival over the years.

Land availability for a new composting facility within the Mahina Commune is limited, and only two potential composting sites within Mahina have been identified. The first is located in a forested area near the current unauthorized Mahina dumpsite (Figure 11). The area is infested with little fire ants, and is located close to a stream. Any compost produced on this site would be at risk of infestation from the little fire ants and would require stringent site maintenance and controls to eliminate or reduce the risk of infestation. Furthermore, the site would require protective measures to reduce the risk of tropical monsoonal flooding from the nearby stream. This is of critical importance as little fire ants can be transported great distances in floods (Wetterer and Porter 2003).

The second potential site is an abandoned dumpsite, which was previously operated as a composting site between 2002 and 2010 (Figure 12). It is reported that some composting infrastructure is already in place, although much of it appears to be now covered with waste materials. As with the first site, this location is infested with little fire ants and would require similar maintenance and controls. Operating a future compost facility at this location would include the added benefit of the concomitant remediation of an abandoned dump.

Recommendation 1: Selection of a future Mahina Commune composting site through an appropriate cost-benefit analysis.

Figure 11. Proposed Mahina composting site ©David Haynes

Figure 12. Disused Mahina composting site. ©David Haynes

5.2. Development of quality assurance procedures for green waste collection and transport

Collection of data on areas affected by the little fire ant in Tahiti was discontinued in 2009. It is therefore difficult to identify which areas of Tahiti, and specifically, which areas of Mahina Commune may be free of the little fire ant. It must therefore be assumed that all transported green wastes from the Mahina area contain little fire ants. It is essential that potentially contaminated waste is transported and handled in a manner that does not contribute to the accidental spread of the little fire ant.

Recommendation 2: Development and testing for standard operational procedures to minimize the spread of little fire ants through green waste transportation and crushing (including cross-contamination from collection equipment).

5.3. Development of optimal green waste composting process to eliminate little fire ants in composting green waste.

There is very little information available on best practice for green waste composting in the presence of little fire ants. The Queensland State Government (Australia) recommends composting in piles no more than 10 metres wide to ensure even pile temperatures, maintenance of minimum distances (5 metres) of compost piles from the perimeter of the storage area, attainment of minimum compost pile temperatures (55 °C for a minimum of 3 days) to kill fire ants; and a minimum spacing of 10 metres between windrows to minimise potential ant contamination between piles (DAFF 2012). In this absence of information, an investigation should identify the combination of conditions that best achieve a 100% kill rate for little fire ants during the composting process in Tahiti including:

- Minimum compost temperature required to kill all fire ants;
- The most appropriate and cost-effective composting method (e.g., in-vessel, open windrows, semi-enclosed (or trough) windrows) to achieve these temperatures throughout the compost; and
- Comparative quality of the compost produced under the various experimental conditions designed to eliminate little fire ants.

Recommendation 3: Design and complete trials to identify cost-effective composting conditions and methods for eradicating little fire ants from green waste while still achieving a quality compost product suitable for commercial and household uses.

5.4. Development of composting site quality assurance procedures

Implementation of routine, cost-effective quality assurance procedures during the production of compost from green wastes will ensure that compost is ant-free, and will assure regulators and consumers that the final compost product does not represent a bio-security threat. Routine assessment of the success (or otherwise) of composting bio-security strategies can be completed to guide management strategies for the composting operation. For example, the Queensland State Government (Australia) recommends 3 monthly pesticide treatment of the composting perimeter with a 30cm barrier of the insecticide chlorpyrifos; and that the treated area must be kept free of material that could form part of an untreated ‘bridge’ to the composting green waste (DAFF 2012). Compost products also need to be protected from little fire ant re-infection at the completion of the composting process. The investigation should also identify the combination of actions that ensure that the composting and compost storage area remains ant free including:

- Recommendation on the most appropriate chemical barrier and its application rates to eliminate little fire ant migration between composting piles or between the surrounding environment and the composting facility[1];
- Environmental monitoring criteria to determine potential contamination risks from the use of boundary chemicals;
- Investigation and recommendation on optimal storage protocols for composted material; and
- Little fire ant baiting and monitoring protocols within the composting facility[2].

Recommendation 4: Design and complete trials that identify cost-effective actions to prevent re-infection of compost with little fire ants during, and following the composting process.

5.5. Optimize mature compost storage and sterilization to eliminate little fire ant transport in the distribution of the final product

Ensuring the final sterility of compost products is critical. Tahitian compost is currently exposed to a methyl bromide treatment to ensure the sterility of the compost prior to use. Open bags of compost are transported to the Papeete port precinct where they are placed in a container and exposed to methyl bromide for 12 hours before being sealed for sale on the domestic market. The necessity of this final sterility step for compost is currently untested.

Recommendation 5: Complete an assessment of the legislative and bio-security necessity for methyl bromide sterilisation of compost products.

5.6. Develop a compost marketing strategy to ensure uptake of the Mahina compost by the Tahitian community

The sustainability of a green waste composting programme for Mahina Commune is dependent on a stable (domestic) market for the compost product. A compost marketing strategy would identify market demand (locally and regionally), assess public perceptions of compost produced from little fire infested green waste, and assess specific steps (if required) to promote public acceptance of the compost product.

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[1] Fipronil (Scharf *et al*. 2000; Potter and Hillery 2002) and chlorpyrifos are two potential insecticide options for assessment. Fipronil is highly toxic to fish and aquatic invertebrates, however, its tendency to bind to sediments, low volatility and its low water solubility may reduce potential hazard to local aquatic ecosystems. Chlorpyrifos is recommended by the Queensland Government.

[2] Monitoring for the presence of little fire ants in and between compost windrows is a relatively straight forward practice using peanut butter baits on wooden spatulas. The presence or absence of little fire ants amongst the collected ants can be ascertained using a microscope and a simple, dichotomous key utilizing information such as size, color and body ornamentation of the collected ants.

This could also include recommendations for innovative compost marketing strategies such as subsidised distribution of Mahina Commune compost at the commencement of the programme.

Recommendation 6: Develop an innovative marketing and communication plan for compost products to ensure expanding compost sales of Mahina compost products.

6. Recommendations for bulky (oversized waste) management

There is very little information available on best practice for management of oversized waste in the presence of little fire ants. Strict adherence to routine quality assurance measures associated with oversized waste collection and compaction could help ensure that the little fire ant is not transported in metal and other oversized wastes following collection.

6.1. Development and dissemination of public guidance on bulky waste

Detailed guidance for residents and the recycling industry on the management of oversized waste needs to be developed and disseminated. This information will minimise the potential transportation risk of little fire ants in collected oversized waste.

Recommendation 7: Development and testing of standard operational procedures to minimize the spread of little fire ants through oversized waste collection, transportation and compaction (including cross-contamination from collection equipment).

6.2. Development of quality assurance procedures for sterilization of oversized waste.

Oversized waste should be sterilised following collection and compaction to remove any associated little fire ants. The sterilised waste should then be stored in a secure, ant free location that has regular ant surveillance and monitoring in place until exported. There are likely to be only two practical alternatives for sterilization of oversized wastes: methyl bromide treatment or heat treatment.

i. *Methyl bromide* is an organo-bromine compound. As a fumigant, it is typically used in concentrations of $48 g/m^3$, which is about 13,000 parts per million (ppm). At this concentration, methyl bromide is acutely toxic to a wide range of insect pests, plants, animals and people. It was used extensively as a pesticide until being phased out by most countries in the early 2000’s as it is a potent ozone depleting substance. Quarantine and pre-shipment use of methyl bromide for pest control is not controlled under the Montreal Protocol.

ii. *Dry heat treatment* is an alternative to the use of methyl bromide. Depending on the product, the rate for heat treatment may range from 55°C to 85°C for 10 minutes to 15 hour intervals, which are the temperatures and times approved by Biosecurity New Zealand. Insects are usually unable to survive even short exposure (less than 24h) to temperatures above 50°C (Hosking 2002). Heat treatment has been accepted as a quarantine treatment for logs and timber to be shipped to the USA and many other countries for many years (e.g. USDA 1996). The general specification has been to reach a core temperature of 71°C for 60 minutes. Currently 56°C for 30 minutes core temperature is sufficient for wood packaging.

Recommendation 8: Complete controlled experiments to determine the efficacy and cost-effectiveness of natural heat (achieved through long-term sunlight exposure on metal shipping containers and their contents) and artificial heat treatment of oversized wastes to eliminate little fire ants as an alternative to continued use of methyl bromide fumigation of compacted, oversized waste.

6.3. Development of national standards and regulations (for review) that will contribute to reducing the spread of little fire ants through improved waste management activities across French Polynesia.

Recommendation 9: Draft national standards and regulations (for review) that will contribute to reducing the spread of little fire ants through improved waste management activities across French Polynesia.

6.4. Remediation of the unauthorised Mahina Commune dumpsite.

Recommendation 10: Discontinue the use of the unauthorised dumpsite in Mahina Commune as soon as possible and remove all waste (green waste, oversized waste and other waste) and remediate the site.

7. Cost estimate for green and oversized waste recommendations

Recommendation	**Activity**	**Cost ($US)**	**Timeframe**	**Partners**
Recommendation 1	*Selection of a future Mahina Commune composting site through an appropriate cost-benefit analysis*	$4,200	Q2 2013	Pae Tai-Pae Uta Mahina Commune
Recommendation 2	*Development and testing of standard operational procedures to minimize the spread of little fire ants through green waste transportation and crushing*	$5,000	Q2 2013	SEP University of Hawaii
Recommendation 3	*Design and complete trials to identify cost-effective composting conditions and methods for eradicating little fire ants from green waste while still achieving a quality compost product suitable for commercial and household uses.*	$9,000	Q2/Q3 2013 (3 months)	DIREN Technival University of French Polynesia

Recommendation 4	*Completion of trials to identify cost-effective actions for securing a composting site from re-infection with little fire ants during, and following the composting process:* • *Windrow temperature monitoring* • *Ant monitoring protocols* • *Ant barriers* • *Pesticide runoff monitoring*	$6,500 $10,000 $2,000 $2,000	Q4 2013	DIREN
Recommendation 5	*Complete an assessment of the necessity for post compost production methyl bromide compost sterilisation*	$5,000	Q2/Q3 2013	DIREN
Recommendation 6	*Develop an innovative marketing and communication plan for compost products*	$3,000	Q4 2013 1 month	Pae Tai-Pae Uta Technival
Recommendation 7	*Development and testing of standard operational procedures to minimize the spread of little fire ants through oversized waste collection, transportation and compaction*	$5,000	Q3 2013	
Recommendation 8	*Complete controlled experiments to determine the efficacy and cost-effectiveness of heat treatment of oversized wastes to eliminate little fire ants.*	$5,000	Q2/Q3 2013	SEP University of French Polynesia
Recommendation 9	*Draft national standards and regulations for review that will contribute to reducing the spread of little fire ants through improved waste management activities across French Polynesia.*	$5,000	Q4 2013	SPREP DIREN
Recommendation 10	*That the use of the unauthorised dumpsite in Mahina be discontinued as soon as possible and that all waste (green waste, oversized waste and other waste) be removed and the site remediated.*	Not within this budget		Mahina Commune DIREN
Project management and support	*SPREP Waste Management and Pollution Control Division missions to supervise work of consultants and provide technical assistance (two 1-week missions)*	$7,000	Q2 2013 Q3 2013	SPREP
	TOTAL	**$68,700**		

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