

# REVIEW OF THE USE OF METSULFURON-METHYL FOR PEST PLANT CONTROL IN PARKS AND RESERVES MAINTAINED BY TAURANGA CITY COUNCIL

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R5484



# **REVIEW OF THE USE OF METSULFURON-METHYL FOR PEST PLANT CONTROL IN PARKS AND RESERVES MAINTAINED BY TAURANGA CITY COUNCIL**

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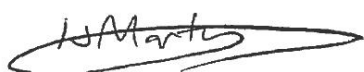
**Prepared for:**

Tauranga City Council

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# 1. INTRODUCTION

Tauranga City Council (TCC) have developed an extensive program of works to enhance natural biodiversity values within the city. This includes the maintenance and management of revegetation sites, restoration of Special Ecological Areas (SEA), and pest plant and animal control work across a number of parks and reserves maintained by TCC.

The scope of works for pest plant control includes all parks and reserves managed by TCC which exhibit natural values, with a particular emphasis on coastal foredunes given their designation as SEA. Pest plant control is regulated by TCC under an agrichemical policy<sup>1</sup> which specifies the use, application, and types of treatments that are able to be used. One of the agrichemicals specified under Schedule 1 of the policy is the herbicide metsulfuron-methyl<sup>2</sup>. Currently in the city, metsulfuron-methyl is restricted to use on wild ginger (*Hedychium gardnerianum*) and gorse (*Ulex europaeus*) in any location, and on agapanthus (*Agapanthus praecox*) within coastal dunes. It is also designated for use on bushy asparagus (*Asparagus aethiopicus*) within coastal dunes until the 1<sup>st</sup> September 2020, after which its use for this purpose expires.

Metsulfuron-methyl, however, is considered to be the best available chemical to effectively and efficiently control a number of additional pest plant species that are prevalent within parks and reserves maintained by TCC. These species include climbing asparagus (*Asparagus scandens*), arum lily / green goddess (*Zantedeschia aethiopica*), Italian arum (*Arum italicum*), montbretia (*Crocasmia × crocosmiiflora*), canna lily (*Canna indica*), crinum lily (*Crinum* spp.), elephant's ear (*Alocasia brisbanensis*), ivy (*Hedera* spp.), fruit salad plant (*Monstera deliciosa*), narrow leaved palm lily (*Cordyline* spp.), strawberry guava (*Psidium cattleianum*), taro (*Colocasia esculenta*), ti (*Cordyline fruticosa*), tuber ladder fern (*Nephrolepis cordifolia*), aloe vera (*Aloe barbadensis*), cherry (*Prunus* spp.) and periwinkle (*Vinca major*).

Bushy asparagus, in particular, is considered to be of significant concern in coastal sand dunes given the difficulty to control its spread and distribution. This invasive species forms dense monocultures that can smother low growing vegetation. It has seeds that are widely dispersed by birds, and it can also resprout from long-lived tubers, fragments of which are spread by the dispersal of soil and water (Weedbusters n.d). It therefore presents a significant risk to native sand-binding foredune species such as spinifex (*Spinifex sericeus*), pīngao (*Ficinia spiralis*) and pōhuehue (*Muehlenbeckia* spp.), and by outcompeting these species it may also exacerbate erosion, and the extent and prevalence of dune blowouts.

Alternative agrichemicals to metsulfuron-methyl that are used on pest plant species, such as glyphosate (the active ingredient used in products such as Roundup<sup>3</sup>), typically require repeated applications at higher dosages and are not considered to be as effective or efficient as control measures. Continuing to use these alternatives will

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<sup>1</sup> The formal TCC policy title is: 'Use of toxic agrichemicals for vegetation management'.

<sup>2</sup> The active ingredient in products such as Escort.

<sup>3</sup> The brand name of a systemic, broad-spectrum glyphosate-based herbicide originally produced by Monsanto, which Bayer acquired in 2018.

also increase the volume of agrichemicals that need to be applied for control works, contrary to the Council's stated intention within the agrichemical policy.

This report provides context on the use, application, and overall effectiveness of metsulfuron-methyl. It includes an assessment of alternative control measures, and an assessment of environmental impacts. Best practice guidelines for the use of agrichemicals, including metsulfuron-methyl, are then provided, along with a proposed amendment to the current agrichemical policy to better regulate the use of metsulfuron-methyl whilst prioritising the protection of public health.

## 2. THE USE, APPLICATION, AND COMPARATIVE EFFECTIVENESS OF METSULFURON METHYL

Metsulfuron-methyl is an organic compound widely used as a herbicide for the control of pest plants. It is a potent inhibitor of plant growth and works by impeding cell division in the formation of roots, shoots, and reproductive tissue such as seeds or berries of (primarily) dicotyledon species (Nelemans *et al.* 2017). In New Zealand, it is commonly applied to initially clear and then suppress woody weeds such as gorse (*Ulex europaeus*), broom (*Cytisus scoparius*), and blackberry (*Rubus fruticosus*) for forestry plantations (Tran *et al.* 2015). It is also considered highly effective at controlling some exotic annual grasses (Nelemans *et al.* 2017). In parks and reserves maintained by TCC, metsulfuron-methyl is typically mixed into a solution in accordance with the products recommended concentration. It is then applied by trained staff (e.g. those with a Growsafe certificate) to target pest plant species through directly spraying foliage.

While metsulfuron-methyl is rapidly taken up by plant and foliage and translocated throughout the plant, it is not persistent in the tissues of vegetative matter (Technical Compliance Consultants NZ Ltd 2019). However, the chemical has high residual properties in soils and can persist in an active form for a considerable period post-application (Tran *et al.* 2015). The reported average half-life<sup>1</sup> of metsulfuron-methyl is 30 days (Technical Compliance Consultants NZ Ltd 2019), with a range of 5-63 days (Tran *et al.* 2019) dependant on soil typology and characteristics. The principal mode of degradation is through microbial breakdown and hydrolysis (Tran *et al.* 2015), with more acidic soils (e.g. volcanic Andosols with lower pH), higher soil moisture and organic matter content, and warmer temperatures correlating with faster degradation (Rahman *et al.* 1991; Technical Compliance Consultants NZ Ltd 2019).

In contrast, herbicides such as glyphosate kill pest plants directly on application and leave no residue within the soil (Tran *et al.*, 2015). Glyphosate is typically applied directly to foliage, or cut stems in gel form, where it is absorbed and translocated to growing roots, leaves, and buds. At these growth points it acts to inhibit enzymes involved in the synthesis of amino acids necessary for cellular maintenance and reproduction (NPIC 2010). Because it is only effective on actively growing plants, and leaves no soil residue, it cannot prevent dormant seeds and tubers from subsequently germinating (NPIC 2010). This means that for persistent pest plants

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<sup>1</sup> Herbicide persistence is usually assessed by estimating a half-life, or the time taken for its activity to be reduced by 50% through dissipation from the soil (Helling 2005).

such as bushy asparagus and arum lily, the use of glyphosate requires regular, repeat applications. Wildlands Consultants, for instance, conducted a monitoring study on the effectiveness of glyphosate on arum lily at Centennial Park in Auckland where the plants were cut at ground level and a gel paste then applied to stumps. The results showed that gel application had limited effectiveness and did not suppress the growth and development of new stems (Appendix 1). In contrast, the residual soil properties of metsulfuron-methyl can be effective at suppressing plant growth for some time after application through preventing seed germination, seedling emergence, and/or development (Ketchum and Rose 2003). Metsulfuron-methyl, therefore, requires less frequent application than glyphosate and can reduce the overall volume of agrichemicals used in pest plant control.

### 3. ENVIRONMENTAL IMPACTS

While the use of pesticides and herbicides in agricultural practices over recent decades has been instrumental in facilitating the ‘green revolution’ through increasing crop yields (Dubey *et al.*, 2010), it has also led to general concerns regarding their potential threat as contaminants in soil and aquatic environments (Baskaran *et al.* 1996).

Metsulfuron-methyl is noted as an effective and efficient means of pest plant control (particularly for hard to control species) yet is considered to be very toxic to aquatic organisms and soil biota. It can also cause eye irritation and mild skin irritation in humans (Adama 2016). Metsulfuron-methyl forms a weak acid that absorbs poorly in neutral and alkaline soils (e.g. clay soils) and is therefore considered potentially leachable (Cedergreen *et al.* 2004). Some studies have shown that even doses under 1% of the recommended application rate can have a significant effect on the growth, morphology, and reproduction of non-target terrestrial plants (see Boutin *et al.*, 2000; Fletcher *et al.*, 1996; and Bhatti *et al.*, 1995). This means specifically targeted application (as opposed to indirect aerial spraying, for instance) is of paramount importance in urban settings such as Tauranga.

Adverse effects of metsulfuron-methyl on aquatic flora could be expected if the herbicide leached into adjacent water bodies, even at small doses. However, a comprehensive study of the effects on a suite of non-target aquatic macrophyte plants was undertaken by Cedergreen *et al.* in Denmark (2004), and does not support this observation. The study concluded that these aquatic species displayed remarkably high tolerance to the herbicide in comparison to terrestrial species commonly targeted, such as oil-seed rape (Cedergreen *et al.* 2004). However, most studies on the potential contamination of water bodies by herbicides such as metsulfuron-methyl have been undertaken overseas. Given the unique nature of New Zealand’s soils (e.g. volcanic soils and soils containing high organic matter content), the applicability of these studies to New Zealand conditions is limited (Wildland Consultants 2016), and a conservative approach should be applied when working near water bodies. The lack of herbicide monitoring programs on surface water quality in New Zealand (Sarmah *et al.* 2004), the questionable applicability of overseas studies (Wildland Consultants 2016), and a paucity of studies which have systematically monitored the effectiveness of various herbicides in pest plant control operations in general, identifies a significant knowledge gap, and signals a strong research prerogative.

#### 4. BEST PRACTICE GUIDELINES FOR THE APPLICATION OF AGRICHEMICALS, INCLUDING METSULFURON METHYL

The following guidelines are considered best practice for the application of agrichemicals, including metsulfuron-methyl, to control pest plants in parks and reserves maintained by TCC:

- To minimise leachate into waterways, the ideal soil conditions for applying agrichemicals are dry soil profiles with a moist soil surface (The Voluntary Initiative 2011).
- The agrichemical used should be the one with the least toxicity and risk that will achieve control of the target pest plant species (FITEC 2007). Appendix 2 provides an example of internal guidance for agrichemical use developed and implemented by Wildland Consultants for some of the pest plant species identified in this report.
- Wherever possible, agrichemicals should be applied by drill and inject techniques or direct spraying of weeds using a nozzle producing a coarse spray droplet. As drill and inject techniques require agrichemicals at higher concentrations than foliage spraying, care should be taken to dispense the agrichemical from spill-resistant containers.
- Apply a minimum 2 metre buffer width if applying agrichemicals near any water body, and direct spray away from the water (CRC n.d).
- When spraying, avoid as far as possible deposition of agrichemicals onto hard surfaces such as concrete, gravel, or rocks where they may be washed into water bodies by rain (CRC n.d).
- Use all agrichemicals strictly in accordance with the products Safety Data Sheet (SDS), Label, and New Zealand Standard NZS 8409:2004 Management of Agrichemicals. Appendix 3 provides an example of a SDS for metsulfuron-methyl.
- Agrichemicals are to be applied only by personal with suitable qualifications such as Growsafe.
- Information on the application of agrichemicals is to be accurately recorded (e.g. type, volume, date, location, environmental conditions, and weather variables) to enable auditing and monitoring.

Additionally, given the dearth of studies conducted in New Zealand, it is also recommended that a robust, systematic monitoring program is undertaken in conjunction with current pest plant management practices. Such a monitoring program would be implemented to academic standards and designed to:

- Compare the effectiveness and efficiency of metsulfuron-methyl, other herbicides, and manual control methods as pest plant control methods;



- Assess any impacts on non-target species, specifically including aquatic and saline herbaceous vegetation;
- Assess residual periods of metsulfuron-methyl in soils; and
- Test water bodies near sites of application to assess compliance with the Australian and New Zealand Environment and Conservation Council (ANZECC) guidelines (2000) threshold value for metsulfuron-methyl (0.008 mg L<sup>-1</sup>).

## 5. PROPOSED AMENDMENTS TO COUNCILS AGRICHEMICAL POLICY

The results of this review support two recommended amendments to the Council's agrichemical policy as it pertains to the use of agrichemicals to control pest plants in parks and reserves maintained by TCC. These recommendations are as follows:

- amend the policy objectives of the agrichemical policy, and
- amend Schedule 1 to regulate the use of metsulfuron-methyl as follows.

Insertion of the word 'efficient' in the second bullet point of the objectives to read as follows (our emphasis in *italics*):

'The primary objective of this policy is to protect public health. Other objectives include:

- The protection of the wider environment from undue harm (including the protection of domestic pets and bird-life from harm), and
- The provision of effective and *efficient* vegetation management on Council maintained land.'

The intent of this proposed change is to also enable consideration of the most efficient vegetation management methods (e.g. cost-effective, least chemical intensive treatments), alongside the provision of effective management for Council maintained land.

The section on metsulfuron-methyl in Schedule 1 of the agrichemical policy is proposed to be amended in the far column of Table 1 below. The intent of the proposed change is to ensure metsulfuron-methyl can be used on a wider range of pest plant species than currently permitted, and in any location maintained by TCC, provided specific conditions are met to protect public health. The best practice guidelines specified in Section 4 of this report should also be followed.

**Table 1:** Proposed amendments to metsulfuron-methyl in Schedule 1 of the agrichemical policy.

Product Name	Active ingredients	Notes (in accordance with Section 5.3)	Suggested amendments to Notes (in accordance with Section 5.3)
Escort*	Metsulfuron-methyl	<p>For use on wild ginger and gorse in any location, and on agapanthus in the coastal dunes.</p> <p>For use on bushy asparagus in the coastal dunes until 1 September 2020.</p> <p>For all locations, application will be by methods that minimise the quantity of chemical used e.g. using direct, limited application methods like weed wiping, stump swabbing and spot spraying where it is practicable.</p>	<p>For use on the pest plant species specified below in any location provided (a) a 2-metre buffer is applied if any water body<sup>1</sup> is located within the vicinity of control works, and (b) control works are not to be undertaken on or above vegetation in any water body:</p> <ul style="list-style-type: none"> <li>• Wild ginger</li> <li>• Gorse</li> <li>• Bushy asparagus</li> <li>• Climbing asparagus</li> <li>• Arum lily / green goddess</li> <li>• Italian arum</li> <li>• Montbretia</li> <li>• Canna lily</li> <li>• Crinum lily</li> <li>• Elephant's ear</li> <li>• Ivy spp.</li> <li>• Fruit salad plant</li> <li>• Narrow leaved palm lily spp.</li> <li>• Strawberry guava</li> <li>• Taro</li> <li>• Ti</li> <li>• Tuber ladder fern</li> <li>• Aloe vera</li> <li>• Cherry spp.</li> <li>• Periwinkle</li> </ul> <p>For all locations, application will be by methods that minimise the quantity of chemical used (e.g. using direct, limited application methods like weed wiping, stump swabbing and spot spraying where it is practicable).</p>

## 6. CONCLUSION

In summary, the use of metsulfuron-methyl to control the key pest plant species specified in this report will improve the effectiveness and efficiency of operations, reduce the overall volume and frequency of agrichemicals used, and is considered to be of minimal risk if correctly applied by qualified applicators. This will help considerably with achieving the goal of enhancing the natural biodiversity values within the city of Tauranga. If a systematic monitoring program is also implemented, this will significantly improve our overall understanding on the effects of agrichemical use.

## ACKNOWLEDGMENTS

<sup>1</sup> A water body means fresh water or geothermal water in a river, lake, stream, pond, wetland, or aquifer, or any part thereof, that is not located within the coastal marine area (RMA 1991, Part 1 Interpretation and application).

This project was initiated by Suzy O'Neill of TCC.

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## RESULTS FROM GLYPHOSATE GEL APPLICATION ON ARUM LILY

Glyphosate gel was applied to arum lily in March 2020 during pest plant control activities undertaken in Centennial Park, Auckland. A) Arum lily plants prior to treatment. B) Arum lily plants cut at ground level and treated with glyphosate gel. C) The same cut plants as seen in (b) from a wider angle. D) An emergent arum lily regrowing from cut stumps just over two months later in May 2020 showing limited effectiveness of glyphosate gel in suppressing growth. E) Close up of stems in (d). F) Regrowth of Arum lily through new shoots in the same location as (b) and (c).



## SELECTED PEST PLANT SPECIES AND RECOMMENDED HERBICIDE TREATMENTS

Pest Plant	Control Method(s)	Chemical(s)	Application Rate	Timing	Remarks
Agapanthus ( <i>Agapanthus praecox</i> )	Dig out and dispose of site	-	-	Year round	Only if this can be done without posing a weed hygiene risk
	Knapsack - foliar spray	Metsulfuron 600g/KG + glyphosate 510g/L	5g metsulfuron + 70ml glyphosate + 10ml organosilicone/10L water	Year round	Will require repeat applications.
		Triclopyr 600g/L	60ml triclopyr + 20ml organosilicone/10L water	Year round	Will require repeat applications.
Arum lily ( <i>Zantedeschia aethiopica</i> )	Cut and treat stems	Metsulfuron 600g/KG + glyphosate 510g/L	1g metsulfuron + 35 ml glyphosate + 1ml organosilicone/1L water	Year round	Slash leaves close to ground, leave on site to rot down. Treat fresh bases with herbicide mix.
	Dig out and dispose off-site	-	-	Year round	Only if this can be done without posing a pest plant hygiene risk.
	Cut and spray stems of large plants	Metsulfuron 600g/KG + Glyphosate 510g/L	1g metsulfuron + 70ml glyphosate/1L water	October-March	Monitor for regrowth. Spray immediately following cutting.
Black taro ( <i>Colocasia esculenta</i> )	Hand pull seedlings/small plants	-	-	Year round	
	Dig out and dispose off-site	-	-	Year round	Only if this can be done without posing a pest plant hygiene risk.
	Cut and spray stems of large plants	Metsulfuron 600g/KG	5g metsulfuron/10L water	October-March	Monitor for regrowth. Spray immediately following cutting.
	Gunspray - foliar spray	Triclopyr 600g/L	300ml triclopyr/100L water	November-February	

Pest Plant	Control Method(s)	Chemical(s)	Application Rate	Timing	Remarks
Bushy asparagus ( <i>Asparagus aethiopicus</i> )	Knapsack - foliar spray	Glyphosate 510g/L	140ml glyphosate/10L water	October-March	DO NOT use penetrant when spraying against tree trunks
	Cut and treat stumps	Glyphosate gel 120g/KG	Paste with glyphosate gel	October-April	
Canna lily ( <i>Canna indica</i> )	Dig out and dispose off-site	-	-	Year round	Only if this can be done without posing a pest plant hygiene risk.
	Cut and treat stumps	Metsulfuron 600g/KG + Glyphosate 510g/L	1g metsulfuron + 35ml glyphosate + 2ml organosilicone/1L water	October-March	Monitor for regrowth. Spray immediately following cutting. Mulch leaves and dispose of seeds at a refuse transfer station
	Knapsack - foliar spray	Metsulfuron 600g/KG + Glyphosate 510g/L	2g metsulfuron + 70ml glyphosate + 10ml organosilicone/10L water	October-March	
Cape ivy ( <i>Senecio angulatus</i> )	Cut stems and treat stumps	Glyphosate gel 120g/KG	Paste with glyphosate gel	November-March	Leave foliage in host to die off. Dropped stems resprout
	Knapsack - foliar spray Foliar spray	Triclopyr 600g/L Metsulfuron 600g/KG	60ml triclopyr/10L water 5g metsulfuron/10L water	November-March Year round	
Climbing asparagus ( <i>Asparagus scandens</i> )	Knapsack - foliar spray	Glyphosate 510g/L	140ml glyphosate/10L water	October-March	DO NOT use penetrant if spraying against tree trunks
			210ml glyphosate/10L water	April-September	ONLY in frost free areas on healthy growth

Pest Plant	Control Method(s)	Chemical(s)	Application Rate	Timing	Remarks
		Clopyralid 300g/L	50ml clopyralid/10 litre water	October-March	Can be foliar sprayed over woody vegetation (avoid Pittosporum sp.) and monocots without damage to these species. BEFORE spraying it is imperative that spray equipment is well rinsed to remove other herbicide residues. DO NOT use penetrants/surfactants. DO NOT spray over water.
	Drill and inject/frill and spray	Glyphosate 510g/L	70ml glyphosate + 2ml organosilicone/1L water	October-April	
	Basal bark application	Triclopyr 600g/L	2L triclopyr + 8L Syntol oil	October-April	ONLY on trees with base diameter <30cm
Crinum lily ( <i>Crinum</i> sp.)	Dig out and dispose off-site	-	-	Year round	Only if this can be done without posing a weed hygiene risk
	Knapsack - foliar spray	Triclopyr 600g/L	60ml triclopyr/10L water	Year round	
	Knapsack - foliar spray	Metsulfuron 600g/KG	2.5g metsulfuron/10L water	Year round	
	Knapsack - foliar spray	Glyphosate 510g/L	70ml glyphosate + 10ml organosilicone/10L water	Spray spring - summer	
		Metsulfuron 600g/KG	5g metsulfuron + 10ml organosilicone/10L water	Spray spring - summer	
		Triclopyr 600g/L	60ml triclopyr + 10ml organosilicone /10L water	Spray spring - summer	
Elephants ear's ( <i>Alocasia brisbanensis</i> )	Hand pull seedlings/small plants	-	-	Year round	



Pest Plant	Control Method(s)	Chemical(s)	Application Rate	Timing	Remarks
	Dig out and dispose off-site	-	-	Year round	Only if this can be done without posing a pest plant hygiene risk.
	Cut and spray stems of large plants	Metsulfuron 600g/KG	5g metsulfuron/10L water	October-March	Monitor for regrowth. Spray immediately following cutting.
English ivy ( <i>Hedera helix</i> )	Cut stems and treat stumps	Glyphosate gel 120g/KG	Paste with glyphosate gel	November-March	Leave foliage in host to die off.
	Knapsack - foliar spray	Metsulfuron 600g/KG	5g metsulfuron + 20ml organosilicone /10L water	November-March	
		Glyphosate 510g/L	70ml glyphosate + 20ml organosilicone/10L water	November-March	
Fruit salad plant ( <i>Monstera deliciosa</i> )	Hand pull seedlings/small plants	-	-	Year round	
	Cut and treat stump	Metsulfuron 600g/KG	5g metsulfuron/1L water	October-March	
	Cut and treat stumps	Glyphosate gel 120g/KG	Paste with glyphosate gel	October-April	
Gorse ( <i>Ulex europaeus</i> )	Cut and treat stumps	Glyphosate gel 120g/KG	Paste with glyphosate gel	October-March	
	Knapsack - foliar spray	Triclopyr 600g/L	60ml triclopyr + 10ml organosilicone/10L water	October-March	
		Metsulfuron 600g/KG	5g metsulfuron + 10ml organosilicone/10L water	October-March	
Italian arum ( <i>Arum italicum</i> )	Dig out and dispose off-site	-	-	Year round	Only if this can be done without posing a pest plant hygiene risk.
	Cut and spray stems	Metsulfuron 600g/KG + Glyphosate 510g/L	5g metsulfuron + 70ml glyphosate + 2ml organosilicone/1L water	October-March	Monitor for regrowth. Spray immediately following cutting.
Kahili ginger ( <i>Hedychium</i> )	Hand pull seedlings/small plants.	-	-	October to February	Ensure no tuber left behind.

Pest Plant	Control Method(s)	Chemical(s)	Application Rate	Timing	Remarks
<i>gardnerianum</i> )	Knapsack - foliar spray	Metsulfuron 600g/KG	5g metsulfuron + 10ml organosilicone/10L water	October-April	Not for use around native vegetation or waterways.
	Cut and treat stems/tubers (recommended method)	Metsulfuron 600g/KG	1g metsulfuron/1L water	October-April	For application near waterways and indigenous vegetation.
		Glyphosate gel 120g/KG	Paste with glyphosate gel	October-April	For small infestations and application near waterways and indigenous vegetation.
Montbretia ( <i>Crocasmia xcrocosmiiflora</i> )	Knapsack - foliar spray	Glyphosate 510g/L	100ml glyphosate + 10ml organosilicone/10L water	October-February	Follow-up control will be necessary.
		Metsulfuron 600g/KG + glyphosate 510g/L	5g metsulfuron + 70ml glyphosate + 10ml organosilicone/10L water	October-February	
		Picloram gel 43g/KG	Paste with picloram gel	October-March	
Narrow leaved palm lily ( <i>Cordyline stricta</i> )	Knapsack - foliar spray	Metsulfuron 600g/KG	5g metsulfuron/10L water	October-March	
Ornamental cherry ( <i>Prunus</i> sp.)	Hand pull seedlings/small plants	-	-	November-March	
	Cut and treat stumps	Glyphosate gel 120g/KG	Paste with glyphosate gel	November-March	
	Drill and inject, frill and spray	Glyphosate 510g/L	70ml glyphosate + 2ml organosilicone/1L water	November-March	
Periwinkle ( <i>Vinca major</i> )	Knapsack - foliar spray	Glyphosate 510g/L	140ml glyphosate + 10ml organosilicone/10L water	October-March	Will require repeated treatments.
		Metsulfuron 600g/KG	5g metsulfuron /10L water	October-March	
Strawberry guava ( <i>Psidium cattleianum</i> )	Cut and treat stumps	Glyphosate gel 120g/KG	Paste with glyphosate gel	November-March	
	Drill and inject	Metsulfuron 600g/KG	20g metsulfuron + 2ml organosilicone/1L water	November-March	
Taiwan cherry ( <i>Prunus companulata</i> )	Hand pull seedlings/small plants	-	-	November-March	

Pest Plant	Control Method(s)	Chemical(s)	Application Rate	Timing	Remarks
	Drill and inject, frill and spray	Glyphosate 510g/L	70ml glyphosate + 2ml organosilicone/1L water	November-March	
Taro ( <i>Colocasia esculenta</i> )	Hand pull seedlings/small plants	-	-	Year round	
	Dig out and dispose off-site	-	-	Year round	Only if this can be done without posing a pest plant hygiene risk.
	Cut and spray stems of large plants	Metsulfuron 600g/KG	2g metsulfuron/10L water	October-March	Monitor for regrowth. Spray immediately following cutting.
Ti ( <i>Cordyline fruticosa</i> )	Cut and treat stumps	Glyphosate gel 120g/KG	Paste with glyphosate gel	October-March	
	Knapsack - foliar spray	Metsulfuron 600g/KG	5g metsulfuron/10L water	October-March	
Tuber ladder fern ( <i>Nephrolepis cordifolia</i> )	Knapsack - foliar spray	Metsulfuron 600g/KG	5g metsulfuron/10L water	March-May	
Wild ginger ( <i>Hedychium gardnerianum</i> , <i>H. flavescens</i> )	Hand pull seedlings/small plants.	-	-	October to February	Ensure no tuber left behind.
	Knapsack - foliar spray	Metsulfuron 600g/KG	5g metsulfuron + 10ml organosilicone/10L water	October-April	Not for use around native vegetation or waterways.
	Cut and treat stems/tubers (recommended method)	Metsulfuron 600g/KG	20g metsulfuron/10L water	October-April	For application near waterways and indigenous vegetation.
		Glyphosate gel 120g/KG	Paste with glyphosate gel	October-April	For small infestations and application near waterways and indigenous vegetation.

## EXAMPLE SAFETY DATA SHEET FOR METSULFURON-METHYL



Product Name: METSULFURON HERBICIDE

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This revision issued: May, 2019

## SAFETY DATA SHEET

## Section 1. Identification of the material and the supplier

Product: **ADAMA METSULFURON HERBICIDE**  
 Chemical Name of Active Ing: Metsulfuron methyl  
 Product Use: Herbicide  
 Restriction of Use: Refer to Section 15  
  
 New Zealand Supplier: ADAMA New Zealand Ltd  
 Address: Level 1/93 Bolt Road  
 Tahunanui, Nelson  
 Telephone: +64 3 543 8275  
 Fax Number: +64 3 543 8274  
  
 Emergency Telephone: **0800 764 766 (National Poison Centre)**  
 Date of SDS Preparation: 28 May 2019

## Section 2. Hazards Identification

This substance is hazardous according to the *Hazardous Substances (Classification) Notice 2017*

EPA Approval No: HSR00242

## Pictograms



Corrosive

Ecotoxic

Signal Word: **Warning**

HSNO Classification	Hazard Code	Hazard Statement	GHS Category
6.3B	H316	Causes mild skin irritation.	Skin Irrit. 3
6.4A	H319	Causes serious eye irritation.	Eye Irrit. 2A
9.1A	H400/H410	Very toxic to aquatic life. / Very toxic to aquatic life with long lasting effects.	Aquatic Acute 1/Aquatic Chronic 1
9.2A	H421	Very toxic to the soil environment.	

Prevention Code	Prevention Statement
P102	Keep out of reach of children.
P103	Read label before use.
P264	Wash hands thoroughly after handling.
P273	Avoid release to the environment.
P280	Wear protective clothing as detailed in Section 8.

Product Name: METSULFURON HERBICIDE  
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Response Code	Response Statement
P101	If medical advice is needed, have product container or label at hand.
P391	Collect spillage.
P305 + P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P337 + P313	If eye irritation persists: Get medical advice/attention.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.

Storage Code	Storage Statement
None allocated	

Disposal Code	Disposal Statement
P501	Wherever possible completely use material by using according to label instructions. Dispose of unwanted product and wastes from spillages as hazardous substances in accordance with local and national regulations using a licensed waste disposal company. Triple rinse containers and add rinsate to spray tank before puncturing and offering for recycling or landfill. Do not allow product to enter waterways. Do not burn product or container.

### Section 3. Composition / Information on Ingredients

Ingredients	Wt %	CAS NUMBER.
Metsulfuron methyl	60	74223-64-6
Other non-hazardous ingredients	To bal	-

### Section 4. First Aid Measures

Routes of Exposure:

If in Eyes	Rinse cautiously with water for 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice.
If on Skin	Take off contaminated clothing and wash before re-use. Wash with plenty of soap and water. If skin irritation or rash occurs: get medical advice/attention.
If Swallowed	Do not induce vomiting. Wash out mouth with water and drink several glasses of water. Never give anything to the mouth of an unconscious person. If vomiting occurs, place victim face downwards, with the head turned to the side and lower than the hips to prevent vomit entering the lungs. Call a POISON CENTER or doctor/physician if you feel unwell.
If Inhaled	Remove person to fresh air. Remove contaminated clothing and loosen remaining clothing. Allow person to assume most comfortable position and keep warm. Keep at rest until fully recovered. Apply artificial respiration if not breathing. Get medical advice if breathing becomes difficult.

#### Most important symptoms and effects, both acute and delayed

Symptoms:

<b>Ingestion:</b>	Not applicable.
<b>Inhalation:</b>	Not applicable.
<b>Skin:</b>	Causes mild skin irritation.
<b>Eye:</b>	Causes serious eye irritation.

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## Section 5. Fire Fighting Measures

<b>Hazard Type</b>	Non Flammable / Not combustible.
<b>Hazards from products</b>	Fire decomposition products from this product may be toxic if inhaled.
<b>Suitable Extinguishing media</b>	There is no risk of an explosion from this product under normal circumstances if it is involved in a fire. Preferred extinguishing media are carbon dioxide, dry chemicals, foam, water fog.
<b>Precautions for firefighters and special protective clothing</b>	Full protective clothing and self-contained breathing apparatus.
<b>HAZCHEM CODE</b>	3Z

## Section 6. Accidental Release Measures

As a minimum wear overalls, goggles and gloves. Suitable materials for protective clothing include rubber, PVC. If there is a significant chance that dust is likely to build up in cleanup area, we recommend that you use a dust mask.

### Environmental precautions

In the event of a major spill, prevent spillage from entering into drains and water courses.

### Methods and material for containment and cleaning up

Stop leak if safe to do so, and contain spill. Sweep up and shovel or collect recoverable product into labeled containers for recycling or salvage and dispose of promptly. Consider vacuuming if appropriate. Ensure disposal is in compliance with local disposal regulations.

## Section 7. Handling and Storage

### Precautions for Handling:

- Read label before use.
- Avoid release to the environment.
- Do not smoke, drink or eat while using.
- Do not breath dusts.
- Wash hands thoroughly after handling.
- Wear protective clothing as detailed in Section 8.

### Precautions for Storage:

- Store away from incompatible materials listed in Section 10.
- Store in the original, unopened container in a cool, dry place, out of direct sunlight and away from stockfeed or foodstuffs.
- As a Class 9 Substance with Ecotoxicity Classifications storage of ADAMA Metsulfuron Herbicide must be carried out in such a manner as to prevent contamination of waterways. It is recommended that The New Zealand Standard for the Management of Agrichemicals (NZS 8409) is followed as a means of meeting the secondary containment provisions of the HSN0 Emergency Management Regulations.
- Keep out of reach of children.

## Section 8 Exposure Controls / Personal Protection

### WORKPLACE EXPOSURE STANDARDS (provided for guidance only)

Substance	TWA		STEL	
	ppm	mg/m3	ppm	mg/m3

No ingredients have exposure limits

Workplace Exposure Standard – Time Weighted Average (WES-TWA). The time-weighted average exposure standard designed to protect the worker from the effects of long-term exposure. Workplace Exposure Standard – Short-Term Exposure Limit (WES-STEL). The 15-minute average exposure standard. Applies to any 15- Minute period in the working day and is designed to protect the worker against adverse effects of irritation, chronic or irreversible tissue change, or narcosis that may increase the likelihood of accidents. The WES-STEL is not an alternative to the WES-

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TWA; both the short-term and time-weighted average exposures apply. Workplace Exposure Standards and Biological Exposure Indices NOV 2017 9TH EDITION.

### Engineering Controls

Control airborne concentrations below the exposure guidelines. Exhaust ventilation may be necessary under certain confined conditions.

### Personal Protection Equipment



<b>Eyes</b>	Safety goggles or face shield.
<b>Hands and Skin</b>	Wear suitable protective clothing. Chemical resistant boots. Chemical resistant gloves.
<b>Respiratory</b>	Ensure good ventilation. If not adequate, wear a suitable dust respirator.
<b>General</b>	When handling do not eat, drink or smoke. Wash hands thoroughly after handling. Wash clothing separately before re-use.

### Section 9 Physical and Chemical Properties

<b>Appearance</b>	Beige to light brown tubular granule (solid)
<b>Odour</b>	No odour
<b>Odour Threshold</b>	Not applicable
<b>Coefficient pH</b>	4 - 7 (10% solution)
<b>Boiling Point</b>	Expected to decompose before boiling
<b>Melting /Freezing Point</b>	Not applicable
<b>Flash Point</b>	Not applicable
<b>Flammability</b>	Not applicable
<b>Upper and Lower Exposure Limits</b>	Not applicable
<b>Vapour Pressure</b>	Not applicable
<b>Density</b>	Not applicable.
<b>Solubilities</b>	Wettable
<b>Coeff Oil/water distribution:</b>	Not applicable
<b>Auto-ignition Temperature</b>	Not applicable
<b>Kinematic viscosity mm<sup>2</sup>/s 40 °C</b>	Not applicable
<b>Particle Characteristics</b>	Not applicable
<b>Volatiles</b>	Not applicable

### Section 10. Stability and Reactivity

<b>Stability of Substance</b>	This product is stable under normal conditions.
<b>Reactivity</b>	This product is unlikely to react or decompose under normal storage conditions. However, if you have any doubts, contact the supplier for advice on shelf life properties.
<b>Conditions to Avoid</b>	Containers should be kept dry. Protect this product from light. Store in closed original container in a dry, cool, well ventilated area, out of direct sunlight.
<b>Incompatible Materials</b>	Incompatible with strong oxidizing agents.
<b>Hazardous Decomposition Products</b>	If heat to decompose, it emits toxic fumes of carbon monoxide, carbon dioxide, nitrogen oxide and sulfur oxides.

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<b>Section 11</b>	<b>Toxicological Information</b>
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**Acute Effects:**

Swallowed	Not applicable
Dermal	Not applicable
Inhalation	Not applicable
Skin	Causes mild skin irritation.
Eye	Causes severe eye irritation.

**Chronic Effects:**

Carcinogenicity	Not applicable.
Reproductive Toxicity	Not applicable.
Germ Cell Mutagenicity	Not applicable.
Aspiration	Not applicable.
STOT/SE	Not applicable.
STOT/RE	Not applicable.

Acute toxicity - Dermal:	LD50 (rabbit) >2000 mg/kg
Acute toxicity - Inhalation:	LC50 (rat) 5 mg/L (4 hours) (technical material)
Skin irritation:	May be irritating (rabbits)
Eye irritation:	May be irritating (rabbit).
Sensitization :	Non sensitizer (guinea-pig)

**Common name: Metsulfuron**

Chronic toxicity: 2-year feeding study in rats resulted in a NOEL of 25.0 mg/kg/day (or 500 ppm in feed), based on decreased body weight seen at 250 mg/kg/day (5000 ppm) which was the highest dose tested. EPA has based its reference dose (0.25 mg/kg/day) on this study.

Carcinogenicity:	Negative for rats and mice in laboratory tests.
Mutagenicity:	Not mutagenic
Reproduction toxicity:	None

<b>Section 12. Ecotoxicological Information</b>
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HSNO Classes: 9.1A =	Toxic to aquatic life.
9.2A =	Very toxic to the soil environment.

Persistence and degradability	No data available.
Bioaccumulation	No data available.
Mobility in Soil	No data available.
Other adverse effects	No data available.
Precautions	Do not allow to enter waterways.

**Breakdown of chemical in soil and groundwater:** The breakdown of Metsulfuron-methyl in soils is largely dependant on soil temperature, moisture content, and pH. The chemical will degrade faster under acidic conditions and in soils with higher moisture content and higher temperatures. The chemical has a higher mobility potential in alkaline soils than in acidic soils, as it is more soluble under alkaline conditions. Metsulfuron-methyl is stable to photolysis, but will break down in ultraviolet light. Half-life estimates for Metsulfuron-methyl in soil are wide ranging from 14-180 days; with an overall average of reported values of 30 days. Reported half-life values (in days) for soil include: clay = 178; sandy loam = 102; clay loam = 70, 14-28, 14-105; silty loam = 120-180.

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**Breakdown of chemical in surface water:** The dissipation time for Metsulfuron-methyl was investigated in a mixed wood/boreal forest lake. The DT<sub>50</sub> or length of time required for half of the material to dissipate in water was >84 days when high concentrations of Metsulfuron-methyl were applied, and 29.1 days at concentrations that might be expected if the chemical is applied for forestry uses. It is stable to hydrolysis at neutral and alkaline pHs, and has a half-life of 3 weeks at pH 5.0, 25°C and >30 days at 15°C.

**Breakdown of chemical in vegetation:** Metsulfuron-methyl is rapidly taken up by plants at the roots and on foliage. The chemical is translocated throughout the plant, but is not persistent. It is broken down to non-herbicidal products in tolerant plants.

### Section 13. Disposal Considerations

**Disposal Method:** Triple rinse empty container and add rinsate to spray tank. Burn in an appropriate incinerator, if circumstances such as wind direction permit. Otherwise crush or puncture and bury in a suitable landfill, or if appropriate, recycle. Avoid contamination of any water supply with product or empty container.

**Precautions and methods to avoid:**

Avoid contamination of any water supply with product or empty container.

### Section 14 Transport Information

**This product is classified as a Dangerous Good for transport in NZ; NZS 5433:2012**



**Road and Rail Transport**

UN No:	3077
Class-primary	9
Packing Group	III
Proper Shipping Name:	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (Metsulfuron)

**Air Transport**

UN No:	3077
Class-primary	9
Packing Group	III
Proper Shipping Name:	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (Metsulfuron)

**Marine Transport**

UN No:	3077
Class-primary	9
Packing Group	III
Proper Shipping Name:	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (Metsulfuron)
Marine Pollutant	Yes

**Special Provisions:**

If the product's individual container is below 5L/kg, it can be transported as a non-DG as long as the product packaging is still labelled as per DG requirements and the driver is given safety information in accordance with Chapter 3.4 of the UNRTDG.

### Section 15 Regulatory Information

**This substance is hazardous according to the Hazardous Substances (Classification)**

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**Notice 2017**

EPA Approval Code: HSR00242  
 HSNO Classification: 6.3B, 6.4A, 9.1A, 9.2A

Refer to EPA website [www.epa.govt.nz](http://www.epa.govt.nz) for controls document - HSR000242

HSW (HS) Regulations 2017	Trigger Quantity
Signage Trigger Quantities (Schedule 3)	100kg (9.1A)
Emergency Response Plan (Schedule 5)	100kg (9.1A)
Secondary Containment (Schedule 5)	100kg (9.1A)
Tracking (Schedule 26)	Not required
HSW(Hazardous substance) Regulations Part 4 Certified Handlers and supervision and training of workers	HSW Reg 4.5 – 4.6 Information, instruction, training and supervision.
<b>HSNO Additional Controls (Restrictions of use)</b>	
<b>PLEASE REFER TO CONTROLS DOCUMENT FOR ALL CONTROLS</b>	
<b>Hazardous Property Controls Notice 2017</b>	
HPC Notice Part 4 Clause 47	Equipment for class 9 substances must be appropriate
HPC Notice Part 4 Clause 48	Records of application of class 9 pesticides and plant growth regulators
HPC Notice Part 3	Hazardous substances in a place other than a workplace
HPC Notice Part 4 Subpart A	Site and storage controls for class 9 substances
HPC Notice Part 4 Subpart C	Qualifications required for application of class 9 Pesticides
<b>ACVM Act and Regulations</b>	
ACVM Approval No See <a href="http://www.foodsafety.govt.nz">www.foodsafety.govt.nz</a> for registration controls	P7371

**Section 16 Other Information****Glossary**

EC50	Median effective concentration.
EEL	Environmental Exposure Limit.
EPA	Environmental Protection Authority
HSNO	Hazardous Substances and New Organisms.
LC50	Lethal concentration that will kill 50% of the test organisms inhaling or ingesting it.
LD50	Lethal dose to kill 50% of test animals/organisms.
LEL	Lower explosive level.
OSHA	American Occupational Safety and Health Administration.
TEL	Tolerable Exposure Limit.
TLV	Threshold Limit Value-an exposure limit set by responsible authority.
UEL	Upper Explosive Level
WES	Workplace Exposure Limit

**References:**

1. EPA Hazardous Substances (Safety Data Sheets) Notice 2017
2. Workplace Exposure Standards and Biological Exposure Indices Nov 2017 edition.
3. Assigning a hazardous substance to a HSNO Approval (Aug 2013).
4. Transport of Dangerous goods on land NZS 5433:2012
5. HSW (Hazardous Substances) Regulations 2017

**Disclaimer**

This document has been issued by TCC (NZ) Ltd and serves as their Safety Data Sheet ('SDS'). It is based on information concerning the product which has been provided to TCC

Product Name: METSULFURON HERBICIDE  
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 Tel: 64 9 475 5240 [www.techcomp.co.nz](http://www.techcomp.co.nz)

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The information herein is given in good faith, but no warranty, express or implied is made.

Please contact the ADAMA, if further information is required.

Issue Date: 28 May 2019      Review Date: 28 May 2024

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