



ADAMA

Triathlon®

Product Guide



HERBICIDE

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Product overview

Triathlon is a unique broad spectrum herbicide for early season control or suppression of 58 broadleaf weeds in winter cereals, including Wild Radish, Capeweed, Volunteer Canola, Fumitory and Hedge Mustard. Triathlon also provides residual activity to help control later-germinating weeds. It incorporates three herbicidal modes of action for broad spectrum activity and resistance management. It is an excellent rotation option for pyrasulfotole-based herbicides to control resistant Wild Radish biotypes. Triathlon is compatible with wide range of herbicides, fungicides and insecticides, reducing the need for additional applications. Triathlon has been formulated for optimal crop safety and performance in Australian conditions. Triathlon is an emulsifiable concentrate formulation and is available in 20 L, 110 L and 1000 L packs.

At a glance

Three modes of action	Triathlon has three modes of action for broad spectrum activity and use in resistance management programs.
Broad spectrum control	Triathlon provides early season control or suppression of 58 broadleaf weeds, including Wild Radish, Capeweed, Volunteer Canola, Fumitory and Hedge Mustard.
Residual weed control	Triathlon exhibits pre-emergent residual activity up to four weeks after application.
Excellent compatibility	Triathlon is compatible with a wide range of herbicides, fungicides and insecticides, reducing the need for additional applications.
Crop safety	Triathlon has been formulated for optimal crop safety and performance in Australian conditions.



A crop of Hindmarsh barley at Forbes, NSW (2013), 35 days after application with Triathlon (750 mL/ha). Weeds present at the time of application included Wild Radish (cotyledon to stem elongation stage), Capeweed (2 to 8 leaf stage) and Wireweed (cotyledon to 4 leaf stage).

Mode of action

GROUP 12 | 6 | 4 HERBICIDE

Triathlon is a member of the nicotinilide, nitrile and phenoxy groups of herbicides and acts by inhibiting carotenoid biosynthesis at the phytoene desaturase step (PDS inhibitors); inhibiting photosynthesis at photosystem II (PS II inhibitors); and disrupting plant cell growth. Triathlon's primary activity is on emerged broadleaf weeds through foliar uptake. Weeds sprayed with Triathlon will typically show severe bleaching and

will stop growing almost immediately and then gradually die. Triathlon also exhibits pre-emergent residual activity that controls later-germinating weeds up to four weeks after application. For herbicide resistance management, Triathlon is a Group 12, Group 6 and Group 4 herbicide. Wherever possible, Triathlon should be used in rotation with herbicides with different modes of action.

Key mode of action parameters of the three active ingredients in Triathlon.

Active ingredient	Diflufenican	Bromoxynil	MCPA
Concentration (g/L)	25 g/L	150 g/L	250 g/L
HRAC Group	12	6	4
Mode Of Action (MOA)	Inhibitor of carotenoid biosynthesis at the phytoene desaturate step (PDS inhibitors)	Inhibitor of photosynthesis at photosystem II (PS II inhibitors)	Disruptor of plant cell growth
Plant uptake	Foliar, shoots, roots	Foliar	Foliar
Activity	Systemic	Contact	Systemic
Translocation	Limited (xylem only)	Very low	Extensive
Site of action	Apical meristems	Leaf tissue	Shoot & root meristems
Soil residual activity	Up to 4 weeks	No	No
Visual symptoms	Bleaching of younger leaves, followed by death of older leaves	Blisters/necrotic areas on leaves, relatively rapid 'burndown' of plants	Twisting/distortion of stems and leaves, followed by wilting and necrosis
First sign of symptoms	Within 2-7 days	Within 2-7 days	Within 2-7 days

Directions for use

Registered crops

Triathlon is registered for use in Wheat, Barley, Oats, Triticale and Cereal Rye, including cereals undersown with clover.

Application rates

Triathlon is applied at 250 mL to 1000 mL/ha, depending on target weed and weed size.

Weed spectrum

Please consult the product label for detailed information on weeds controlled, size of weeds controlled and rates required.

Water volume

Boom sprayer: Apply in a minimum of 50 L/ha of water. For optimum results, apply in 70–100 L/ha of water. Increase the water volume if weed infestation is heavy or crop cover is dense. Complete coverage of weeds is essential.

Aircraft: Apply in a minimum of 30 L/ha of water. Effective weed control will only be achieved where good coverage of leaf surface is achieved.



Wild Radish at 2-true leaf stage, the ideal weed size for Triathlon application.

Weeds controlled by Triathlon

Amsinckia	Hexham Scent	Saffron Thistle
Canola	Horehound	Scarlet Pimpernel
Capeweed	Horned Poppy	Stemless Thistle
Chamomile	Hyssop Loosestrife	Shepherd's Purse
Charlock	Iceplant*	Skeleton Weed*
Chickweed*	Indian Hedge Mustard	Slender Thistle
Cleavers	Lesser Swinecress	Sorrel
Common Sowthistle	London Rocket	Three-horned Bedstraw
Corn Gromwell	Long Storksbill*	Toad Rush
Cowvine	Marshmallow	Tree Hogweed
Crassula	Mexican Poppy	Turnip Weed
Deadnettle	Mintweed	Variogated Thistle
Dense-flower Fumitory	Mountain Sorrel	Vetch
Dock	Mouse-eared Chickweed*	Volunteer Lupins*
Doublegee (Spiny Emex)	Night-scented Stock*	Ward's Weed
Fat Hen	Paterson's Curse*	Wild Radish
Field Madder	Peppercress*	Wild Turnip
Fireweed*	Prickly Lettuce	Wireweed**
Fumitory	Purple Goosefoot	
Hedge Mustard	Rough Poppy	

*Suppression only **Wireweed growing on low fertility soils will be less susceptible.

Weed application timing

Apply when weeds are small for best results. Early application also allows the herbicide to penetrate an open canopy for good soil coverage and maximum residual activity. Newly-emerged weeds at the 2-true leaf stage will be readily controlled. Larger weeds up to 8 leaves (species dependant) can be controlled at higher label rates. Refer to the label for recommendations by weed species.

Restrictions

DO NOT apply if crop or weeds are stressed due to dry or excessively moist conditions.

DO NOT apply to crops under stress due to disease or insect damage.

DO NOT apply to frost-affected crops or if frosts are imminent.

DO NOT apply when rain is expected within four hours.

Application under adverse conditions can reduce knockdown or residual activity and may lead to increased transient crop bleaching as the crop is less able to metabolise the herbicide. A moist soil surface is required for optimal residual control.

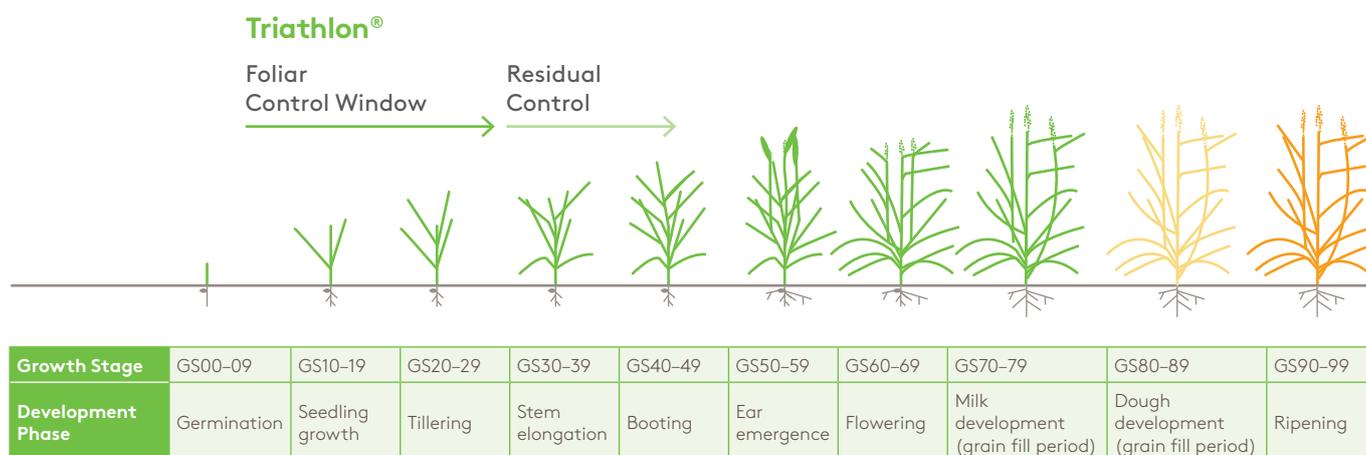
Withholding periods

Harvest: Not required when used as directed.

Grazing: DO NOT graze or cut for stock feed for 14 days after application.

Crop application timing

Triathlon is applied from the 3-leaf stage to fully-tillered crop stages (see diagram below). Best results will be achieved where Triathlon is used early.



The use window in cereals is from 3 leaf stage to fully tillered. Best results will be achieved where Triathlon is used early.

Trial results

Trials conducted throughout Australia have demonstrated that Triathlon has excellent performance across multiple weed species and a strong ability to control later-germinating weeds when used at higher rates. Trial results also indicate the robust crop safety Triathlon exhibits when compared with the market standards.



Untreated Wild Radish (left) next to a plot treated with Triathlon at Roseworthy, SA, 2013.

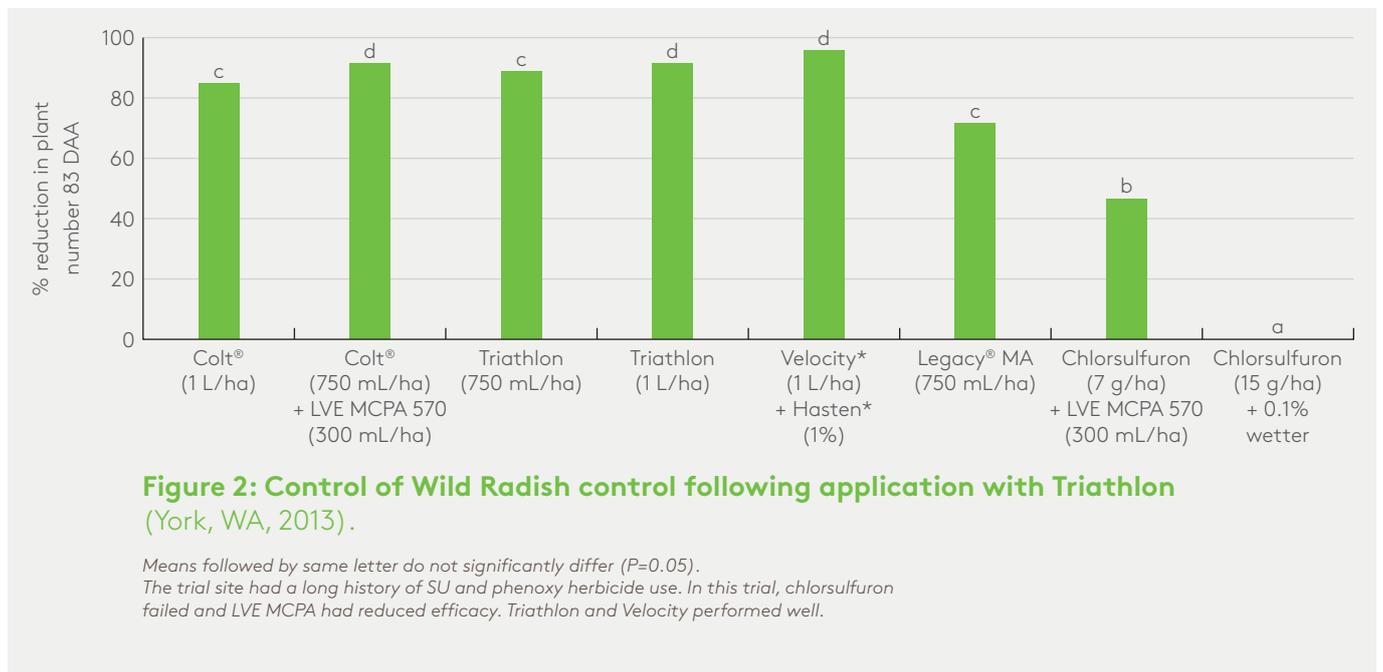
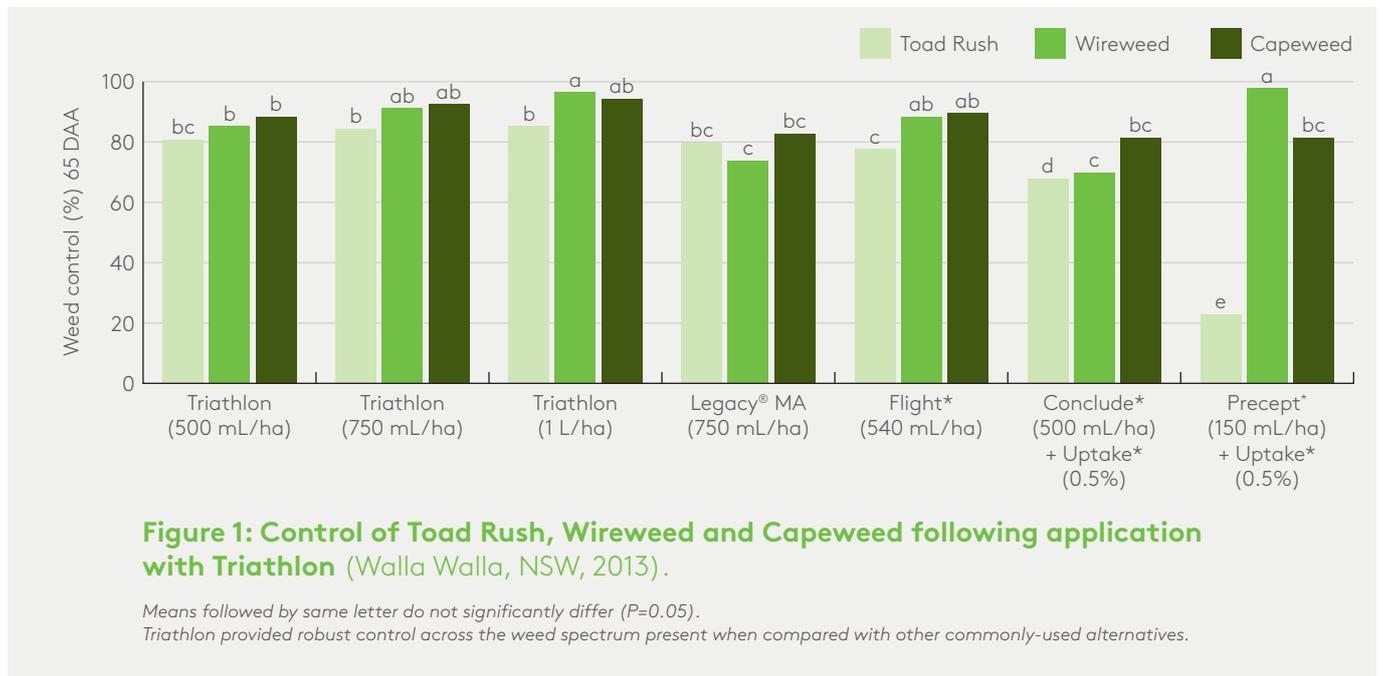




Figure 3: Residual control of Wild Radish following application with Triathlon (Wongan Hills, WA, 2012).

Means followed by same letter do not significantly differ ($P=0.05$).
 This trial demonstrated that maximum residual activity is achieved at the higher Triathlon rate.



Figure 4: Control of Volunteer Canola following application with Triathlon (Colbinabbin, Vic, 2013).

Means followed by same letter do not significantly differ ($P = 0.05$).
 This trial demonstrates Triathlon provides robust control of Volunteer Canola, particularly when compared with Legacy® MA. Canola UTC = 30 plants per square metre, LSD = 8.9, CV = 4.8.

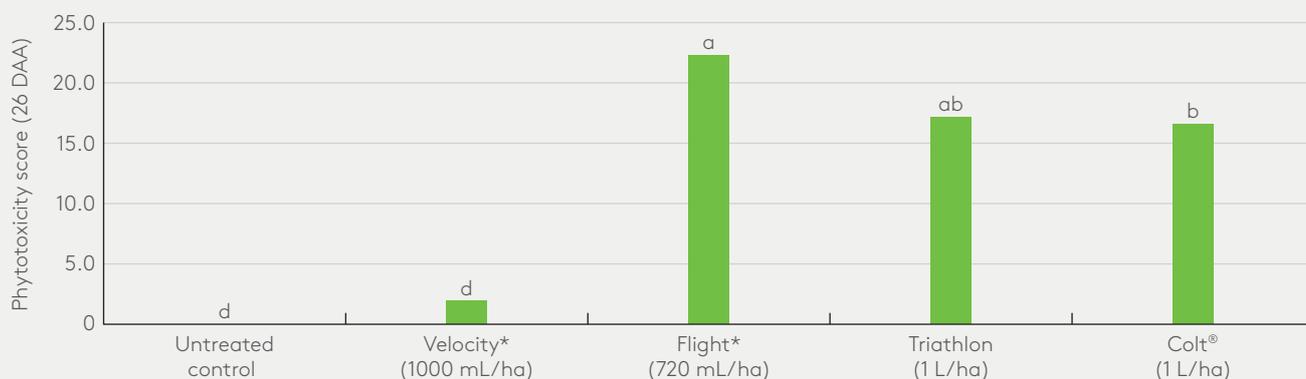


Figure 5: Crop phytotoxicity in wheat following application with Triathlon (Roseworthy, SA, 2012).

Means followed by same letter do not significantly differ ($P=0.05$).
 Crop safety has been extensively tested across major cereal varieties. Triathlon has been shown to be comparable with other herbicides containing diflufenican (DFF), such as Colt® and Legacy® MA. Under certain conditions, Triathlon, similar to other herbicides containing DFF, can cause superficial leaf spotting. However, this does not have any impact on yield. The crop phytotoxicity ratings for Triathlon were, on average, similar to those of Colt® and slightly less than Flight*. LSD 5%, Agrisearch Services, 2012.

Compatibility

Triathlon is a unique broad spectrum herbicide for early broadleaf weed control in winter cereals, incorporating 3 herbicide Modes of Action (MOA). Triathlon is compatible with a range of products and has been extensively tested for crop safety on multiple varieties and situations. The table below summarises the compatibility testing that has been completed to date.

Notes

- Most compatibilities were conducted with Triathlon at 1000 mL/Ha, the highest label rate. Crop safety and any minor mixing issues are likely to be reduced at lower rates of Triathlon
- In all mixtures, observe the entire label requirements of the mixing partner, including recommended crop stage, spray volumes etc
- The Triathlon label recommends not to use crop oils with Triathlon alone or Triathlon tank mixtures with other products. Mixtures with crop oils will always heighten the risk of adverse crop effects
- The physical compatibility test conducted in the laboratory was a more complete test than that conducted in field tests. Mixtures were compared at different water hardness and under different temperatures
- Compatibility is limited to those specific products and product manufacturers listed unless an alternative product is clearly an equivalent formulation
- Adverse environmental conditions such as frosts, waterlogging, drought, pests or anything else that can stress the crop can compound affects to the crop and should be avoided when tank mixing Triathlon.

Product and maximum rate tested	Formulation	Active Constituents	Company	Physically Compatible Yes/No	Crop Safety Field Tests	Recommended Adjuvant	Comments
Alpha-Scud® 300 80 mL/Ha	EC	alpha-cypermethrin 300 g/L	Adama	Yes – 20 L/Ha	Not Tested	Not Required	Not tested biologically.
Atlantis* OD 330 mL/Ha	OD	mesosulfuron 30 g/L + mefenpyr-diethyl 90 g/L	Bayer CropScience	Yes – 20 L/Ha (with constant agitation)	Yes x 6	BS1000* 0.25%	Not recommended. Crop effects in trials were significant.
Axial* 300 mL/Ha	EC	pinoxaden 100 g/L + cloquintocet-mexyl 25 g/L	Syngenta	Yes – 20 L/Ha	Yes x 2	Adigor 0.5%	Increased crop effects were observed in trials. Use with caution.
Crusader* 300 mL/Ha	OD	pyroxulam 30 g/L + cloquintocet-mexyl 90 g/L	Dow AgroSciences	Yes – 50 L/Ha	Not Tested	BS1000* 0.25%	Some increase in crop effects is likely. Use with caution.
Dimethoate® 500 mL/Ha	EC	dimethoate 400 g/L	Adama	Yes – 50 L/Ha	Not Tested	Not Required	Not tested biologically.
Mandate® 125 mL/Ha	EC	clodinafop-propargyl 240 g/L + cloquintocet-mexyl 60 g/L	Adama	Yes – 20 L/Ha	Yes x 4	Uptake* 0.5%	Good crop safety observed in trials. Do not use beyond recommended application window.
Mentor®	EC	metribuzin 750 g/L	Adama	Yes - 50 L/Ha	Yes x 1	Not Required	Increased crop effects were observed in trials. Use with caution.
Moddus† Evo* 400 mL/Ha	DC	trinexapac-ethyl 250 g/L	Syngenta	Yes – 20 L/Ha	Yes x 5	Not Required	Normal crop shortening is observed and some light crop spotting is possible.
UAN – Flexi N* 30 L/Ha	SL	nitrate 25% + ammonium 25% + urea 50%	CSPB	Yes 50/50 Dilution	Yes x 5	Not Required	Some spotting observed in some trials. Commercially acceptable. Apply below 25°C. UAN can burn in some circumstances.
UAN – Flexi N* 50 L/Ha	SL	nitrate 25% + ammonium 25% + urea 50%	CSPB	Yes 50/50 Dilution	Yes x 5	Not Required	Some spotting observed in some trials. Commercially acceptable. Apply below 25°C. UAN can burn in some circumstances.
Victory® SL 50 mL/Ha + LVE MCPA 600 mL/Ha	SL	clopyralid 300 g/L + 570 LVE MCPA ester	Adama	Not Tested	Yes x 2	Not Required	Some minor crop affect was observed. Commercially acceptable.

Tank-mix compatibility is affected by a range of factors

Water quality: Water quality can have a significant effect on tank mix compatibility; some products may be unstable in hard water or breakdown very rapidly in alkaline (high pH) water or react adversely with acid (low pH) water. Adama recommend where possible that rainwater be used for spraying and especially where tank mixing multiple products. When multiple products are to be mixed together or where water quality is uncertain it is recommended that a jar test be performed with the water to be used, prior to mixing large quantities in the boom sprayer.

Formulation quality: Some formulations of products may change from year to year or formulations may not always be of the same quality or as compatible as they were in previous years. This can sometimes be the case with some products from different suppliers and with some crop oils and wetters. Again, Adama recommend doing a jar test to determine if new formulations or new products react the same way in tank mixes as other similar products may have done in the past.

Formulation Type: EC formulations are often believed to be more likely to cause crop effects than other formulation types. Historically the solvents used in EC formulations have had a tendency to be more damaging to crops. However in recent years considerable advances have been made in making EC formulations such as Triathlon safer to crops, users and the environment. The Triathlon formulation can cause typical DFF (diflufenican) leaf spotting under certain conditions and in certain tank mixes but this can be attributed predominantly to the DFF and not the formulation type. When used alone Triathlon will not cause any negative affect to crop yield, however some tank mixes may have an affect under particular conditions.

Water volumes: In most situations, the lower the water volume used for spraying, the higher the probability that any physical incompatibilities between products will become evident. Water volumes should not be a major factor when tank mixing Triathlon as long as the minimum water rates are used; 50 L/Ha by ground and 30 L/Ha by aircraft.

Mixing order

The order in which chemicals are loaded into the spray tank can affect the level of physical compatibility and the following chart is a guide as to the order that should be followed.

Step 1	Water volume to 50%	
Step 2	Water Conditioners (E.g. Ammonium Sulphate, Li-700*)	
Step 3	Water dispersible granules (WG) (E.g. Farnozine® WG, Simanex® WG, Diuron WG, Metsulfuron-methyl, Chlorsulfuron)	
Step 4	Wettable powders (WP) (E.g. Axiom® MZ)	
Step 5	Suspension concentrates (SC) (E.g. Soprano®, Orius®)	
Step 6	Emulsifiable concentrates (EC) (E.g. Triathlon®, Radial®, Trifluralin, Mandate®, 2, 4-D LV Ester 680)	
Step 7	Soluble concentrates (SL) (E.g. Wipe-Out®, Spraytop®, Zulu®)	
Step 8	Adjuvants, wetters and oils (E.g. BS1000*, Hasten*, Kwickin*)	

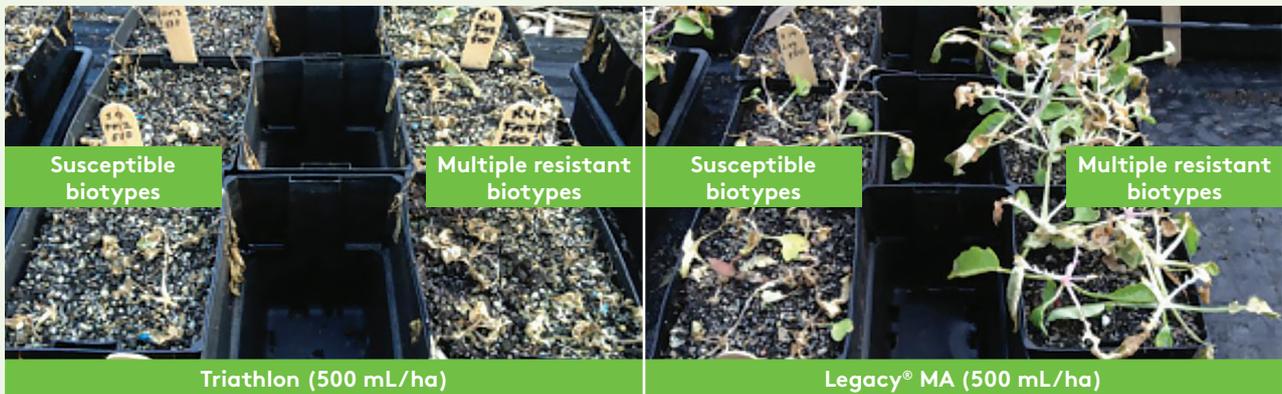


Resistance management

Triathlon contains three different herbicide mode of action groups, making it ideal for herbicide resistance management programs. Where resistance has not yet been detected, Triathlon should be rotated with other modes of action to help minimise resistance development. Where resistance is suspected, Triathlon has shown to be effective against a range of herbicide-resistant weed biotypes but should be rotated with modes of action known to be effective.

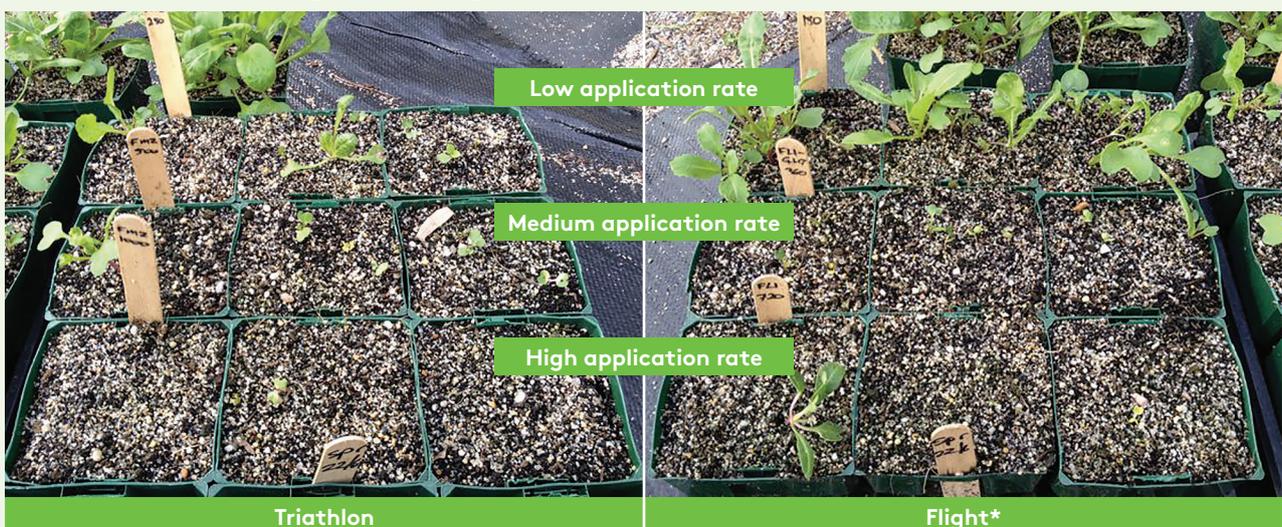
Triathlon should be used with non-chemical resistance management practices, including windrow burning, silage and hay making, spray-topping with selective herbicides and weed seed collection at harvest. Triathlon is also ideal to apply in rotation with HPPD herbicides, particularly on weed species with a history of developing herbicide resistance, such as Wild Radish in Western Australia. Glasshouse trials conducted by the University of Adelaide highlight the effectiveness of Triathlon on multiple resistant Wild Radish biotypes.

Triathlon delivers excellent control of resistant Wild Radish biotypes.



Triathlon has controlled the multiple resistant biotypes whereas Legacy MA failed. (University of Adelaide, 2012).

Triathlon delivers category-leading residual control of Wild Radish.



Equivalent grams active ingredient comparison. Triathlon has demonstrated superior residual activity compared with Flight*. Herbicide treatments were applied to pots prior to germination of weeds (University of Adelaide, 2012).

Adama are proud partners in the industry wide 'WeedSmart' initiative and Triathlon will be a valuable tool to incorporate into resistance management programs as detailed under 'WeedSmart'.

Frequently asked questions

How do I get the best results from Triathlon?

Triathlon can be applied from the 3-leaf crop stage and offers both knockdown and residual control. Knockdown and residual control is generally more effective when Triathlon is applied in earlier stages of crop growth when the canopy is open. Soil contact is critical for achieving residual control with Triathlon. Good coverage of target weeds is important for optimal results. Spray volumes of at least 50 L/ha (and preferably higher) are recommended to achieve maximum coverage of target weeds and exposed soil.

Velocity* and/or Precept* work well on resistant Wild Radish. Why should I use Triathlon?

Precept* and Velocity* are highly effective for post-emergence control of Wild Radish. However, over-reliance on HPPD products is likely to result in the development of herbicide resistance in Wild Radish and other weed species. Resistance to HPPD inhibitors has developed in other weeds in other countries. Rotation between all available modes of action is advised to extend the life of existing herbicides. In addition, unlike Triathlon, pyrasulfotole offers limited residual control, which means under high weed pressure situations, growers may be spraying twice with the same mode of action, which is not a good long-term resistance management strategy.

Diflufenican can sometimes cause phytotoxicity. Should I be cautious with using Triathlon?

In most situations, any leaf discolouration or crop phytotoxicity following application with Triathlon will be transient. The DFF component of

Triathlon acts on the photosynthetic pathway, causing bleaching. Under adverse conditions (i.e. frosts or dry conditions), plants may slow in their metabolism of the herbicide and increased discolouration may occur. This does not usually translate into yield losses.

Why would I use Triathlon instead of Colt® and Legacy® MA?

Colt® and Legacy® MA have two modes of action, making them more prone to failure when used on weed populations that have developed resistance to more than one herbicide mode of action. Triathlon contains DFF for post-emergence and residual weed control, in addition to its other two active ingredients for broader spectrum and reliability. When used as per label recommendations, Triathlon will provide more effective knockdown of a broader weed spectrum of weeds, while providing a good level of residual control of key weeds, such as Wild Radish when used at appropriate rates.

Why wouldn't I simply tank mix my own products rather than buy Triathlon?

Triathlon has been developed with an optimum ratio of the three active ingredients and with a solvent system specifically designed for Australia conditions. Growers using Triathlon don't need to tank mix several products to achieve effective and broad-spectrum weed control. This means a higher loading of active ingredient with less solvent to get the same control. Mixes of Colt® + LVE MCPA or Legacy® MA + bromoxynil require multiple products, meaning more handling, more risk of error during mixing/loading and more drums to transport, store or dispose of. Triathlon is an economical, simple and effective solution.

Control of large Wild Radish 20 DAA (Avon Valley, WA, 2013).



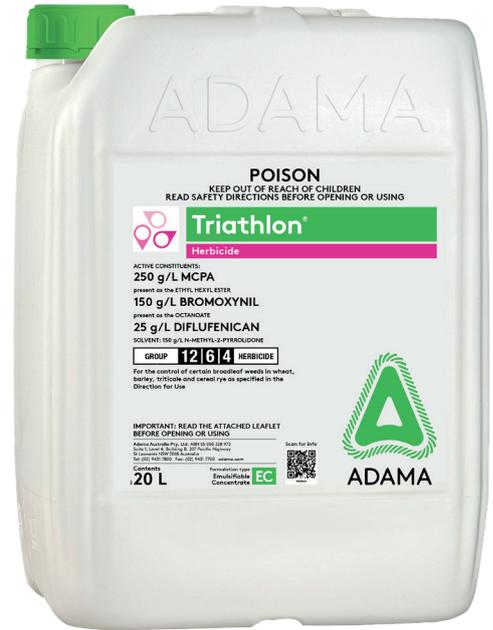
Untreated control

Chlorsulfuron (15 g/ha) +
LVE MCPA (300 mL/ha)

Triathlon (750 mL/ha)

Summary

Three modes of action	Triathlon has three modes of action for broad spectrum activity and use in resistance management programs.
Broad spectrum control	Triathlon provides early season control or suppression of 58 broadleaf weeds, including Wild Radish, Capeweed, Volunteer Canola, Fumitory and Hedge Mustard.
Residual weed control	Triathlon exhibits pre-emergent residual activity up to four weeks after application.
Excellent compatibility	Triathlon is compatible with a wide range of herbicides, fungicides and insecticides, reducing the need for additional applications.
Crop safety	Triathlon has been formulated for optimal crop safety and performance in Australian conditions.



Always read and follow the product label directions of all tank-mix partners. **Care must be taken when tank mixing more than two products, particularly products that are not manufactured by ADAMA, due to potential variation in formulations or product quality. Seek competent advice or perform a jar test if unsure before proceeding.** Note that physical compatibility tests determine whether the products will mix and are suitable for application using commercial spray equipment. Physical compatibility tests do not check for adverse crop effects or the biological efficacy of the individual products when applied as a tank-mix. Recommendations for use, handling, storage and disposal of products may also change over time. The information contained in this document is not intended to replace the product label. The product label, safety data sheet and supporting product information can be viewed on the ADAMA website www.adama.com or by scanning the QR code located on this document or the product packaging.



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