Triathlon®

Technical Product Guide

ADAMA

Introducing Triathlon®

Controlling broadleaf weeds is critical during the important crop establishment phase. Weeds compete for valuable nutrients and moisture and can significantly reduce crop yields if left unchecked.

Triathlon® is a broad spectrum broadleaf herbicide, incorporating 3 Modes of Action (MOA), for early weed control in winter cereals.

Triathlon® is highly effective against a range of broadleaf weeds, including hard-to-control Wild Radish, and has the added benefit of residual activity to help control later germinating weeds.

Triathlon® is ideal for this early post-emergence application timing and its 3 MOA provides a valuable resistance management tool to aid in the control of weed biotypes resistant to existing herbicides.

Triathlon® at a Glance

- Convenient one pass solution for multiple broadleaf weed populations
- Excellent activity on Wild Radish, including key herbicide resistant biotypes
- Additional benefit of residual control of Wild Radish for up to 4 weeks
- Excellent crop safety – extensively tested on multiple varieties and situations
- Optimised formulation for Australian conditions and weeds
- Compatible with a wide range of products
- Excellent rotational option for Wild Radish
- Apply from 3-leaf crop stage for maximum yield benefits.

Registered Crops	Wheat, Barley, Triticale and Cereal Rye
Weed Spectrum	Registered for control or suppression of 58 key broadleaf weeds
Formulation Type	Emulsifiable Concentrate (EC)
Application Rate Range	250 mL –1 L/Ha
Water Rates	Minimum of 50 L/Ha of water by ground application, minimum of 30 L/Ha of water by aerial application

Mode of Action

Triathlon® is a member of the nicotinanilide, 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. The table below highlights the key MOA parameters based on the 3 active ingredients.

Parameter	bromoxynil	MCPA	diflufenican
Concentration (g/L)	150 g/L	250 g/L	25 g/L
HRAC Group	C	I	F
MOA	Inhibitor of photosynthesis at photosystem II (PS II inhibitors)	Disruptor of plant cell growth	Inhibitor of carotenoid biosynthesis at the phytoene desaturate step (PDS inhibitors)
Plant uptake	Foliar	Foliar	Foliar, shoots, roots
Activity	Contact	Systemic	Systemic
Translocation	Very low	Extensive	Limited, xylem only
Site of action	Leaf tissue	Shoot & root meristems	Apical meristems
Soil residual activity	No	No	Up to 4 weeks
Visual symptoms	Blisters/necrotic areas on leaves, relatively rapid "burndown" of plants	Twisting/distortion of stems and leaves, followed by wilting and necrosis	Bleaching of younger leaves, followed by death of older leaves
First sign of symptoms	Within 2-7 days	Within 2-7 days	Within 2-7 days
Outcome	Weeds sprayed with Triathlon® will typically show severe bleaching and will stop growing almost immediately and then gradually die.		

Triathlon® is available in 20 L, 110 L and 1000 L packs.

Triathlon® trial - Forbes, NSW, 2013, Hindmarsh Barley. Triathlon® applied @ 750 mL/Ha. Weeds present: Wild Radish: cotyledon to stem elongation stage, Capeweed 2 to 8 leaf stage, Wireweed: cotyledon to 4 leaf stage. Photo taken 35 DAA

Registered Weeds

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

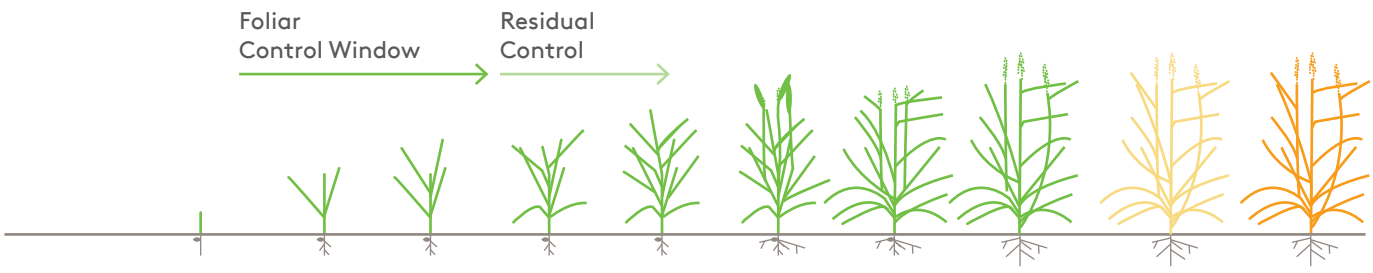
* *Suppression only*
** *Wireweed growing on low fertility soils will be less susceptible*

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

Application

Crop Application Timing

Triathlon®



Zadoks Growth Stage	GS00-09	GS10-19	GS20-29	GS30-39	GS40-49	GS50-59	GS60-69	GS70-79	GS80-89	GS90-99
Development Phase	Germination	Seedling growth	Tillering	Stem elongation	Booting	Ear emergence	Flowering	Milk development (grain fill period)	Dough development (grain fill period)	Ripening

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

Weed Application Timing

Best results will be achieved where weeds are small at time of application. Refer to the label for individual recommendations by weed species. Newly emerged weeds at the 2 true leaf stage will be most readily controlled and this early timing will minimise impact on crop yields. Where earlier application timing cannot be achieved, larger weeds up to 8 leaves (species dependant) can be controlled at higher label rates.

Early application also allows the herbicide to penetrate a more open canopy for good soil coverage and maximum residual activity.

Wild Radish at 2 true leaf stage.
Ideal weed size for Triathlon® application.

Spray Application Recommendations

Boom Sprayer:
A minimum of 50 L of water per hectare should be used, however, for optimum results water rates of 70-100 L/Ha are recommended. 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 water per hectare. Effective weed control will only be achieved where good coverage of the leaf surface is achieved.

Restraints when using Triathlon®

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 4 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.

For best residual control, a moist soil surface is required.

Withholding Periods

Harvest: Not required when used as directed.

Grazing: Do not graze or cut for stock feed for 14 days after application.

Trial Results

Weed Control: Walla Walla, NSW, 65 DAA, 2013

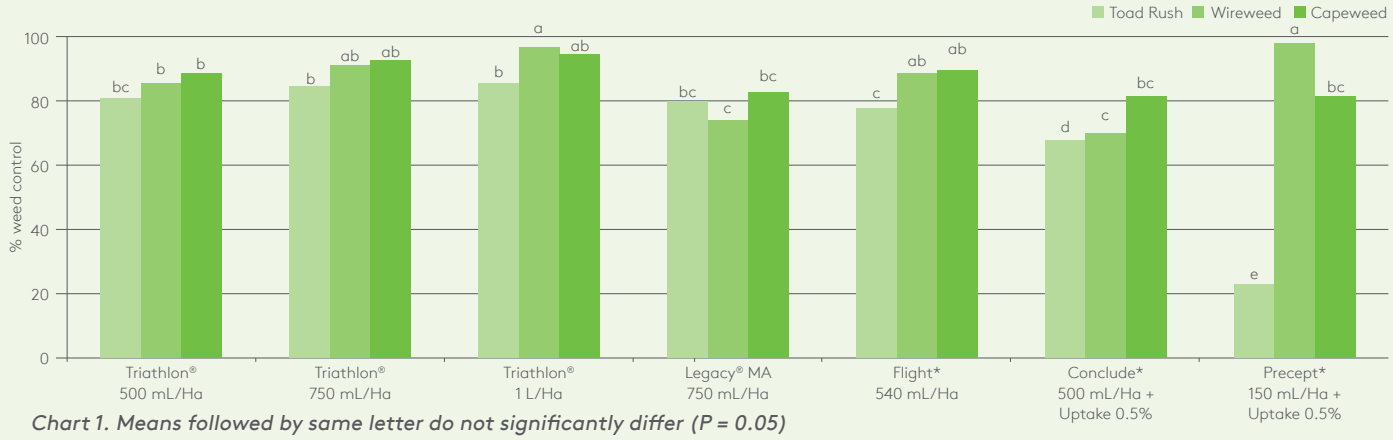


Chart 1. Means followed by same letter do not significantly differ (P = 0.05)

Triathlon® performed well in this trial in Southern NSW against 3 key weeds. Robust control across the weed spectrum present is illustrated when compared with alternatives in the trial.

Reduction In Wild Radish Plant Numbers: York, WA, 83 DAA, 2013

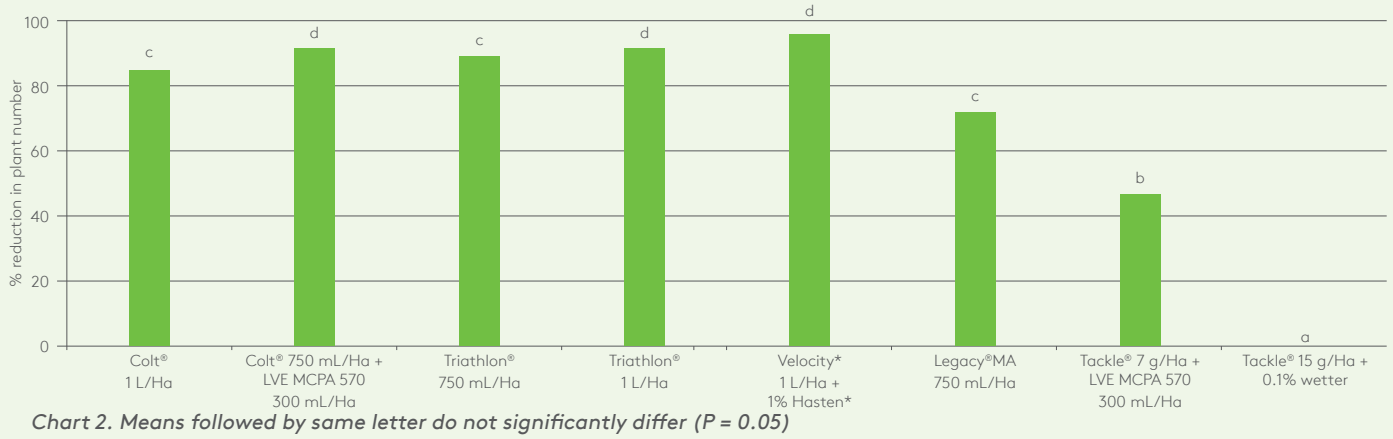


Chart 2. Means followed by same letter do not significantly differ (P = 0.05)

This site at York in Western Australia had a long history of SU and Phenoxy herbicide use. In the trial, Chlorsulfuron failed and LVE MCPA had reduced efficacy. Triathlon® and Velocity performed well.

Residual Weed Control: Wongan Hills, WA, 2012

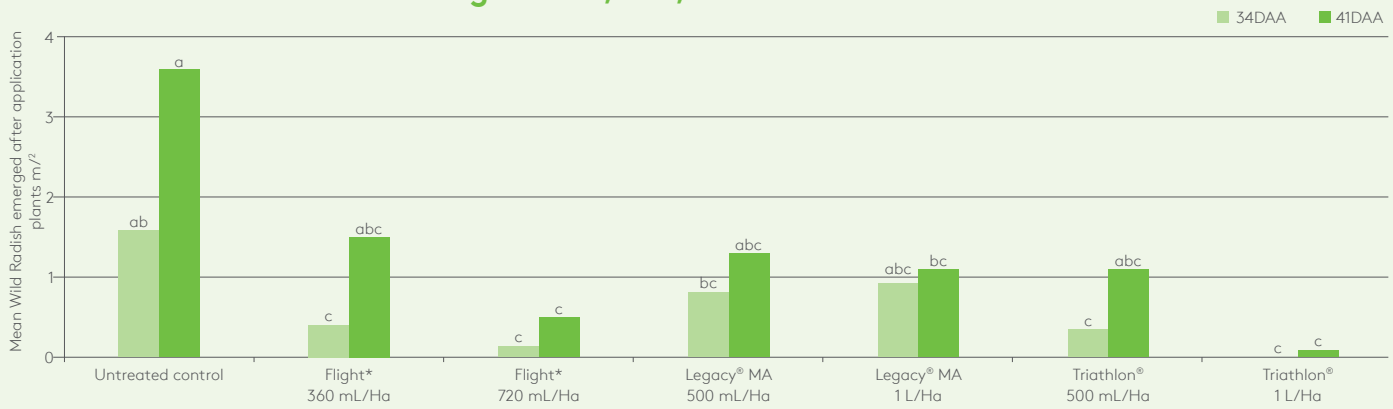


Chart 3. Means followed by same letter do not significantly differ (P = 0.05)

As demonstrated in this trial at Wongan Hills in Western Australia, maximum residual activity is achieved at the higher Triathlon® rates. A strong trend is evident in the results, indicating significantly less emerged weeds at 34 DAA and 41 DAA where the 1 L/Ha rate of Triathlon® is used.

**Registered Trademarks.*

Volunteer Canola Control: 39 DAA - Colbinabbin, Vic, 2013

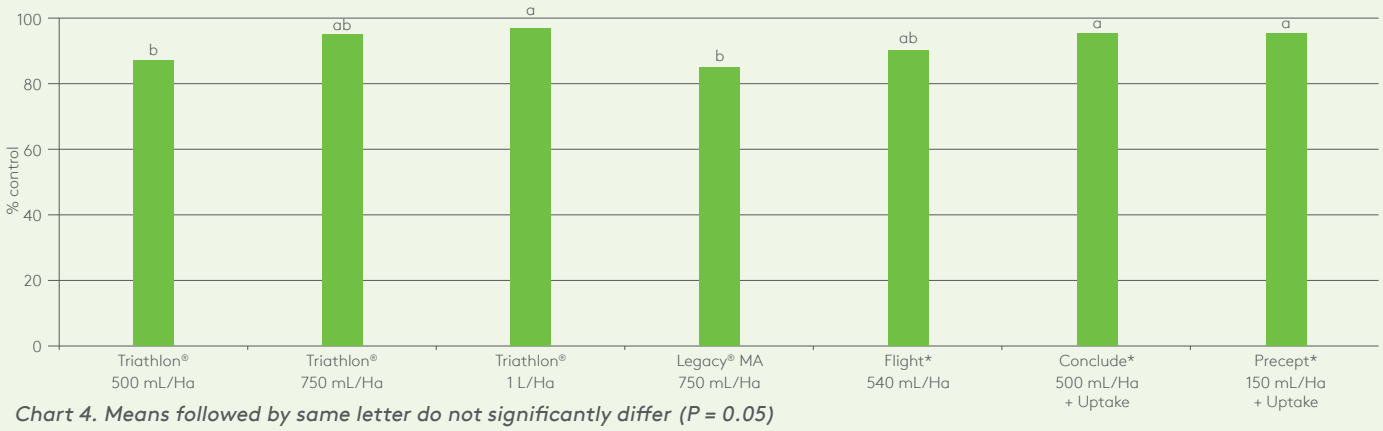


Chart 4. Means followed by same letter do not significantly differ (P = 0.05)

This trial at Colbinabbin in Victoria highlights the robust control of volunteer canola that can be achieved with Triathlon® and the improvement over the control level provided by Legacy® MA. Canola UTC 30 plants m², LSD = 8.9 CV = 4.8

Crop Phytotoxicity - Wheat: 26 DAA - Roseworthy, SA, 2012

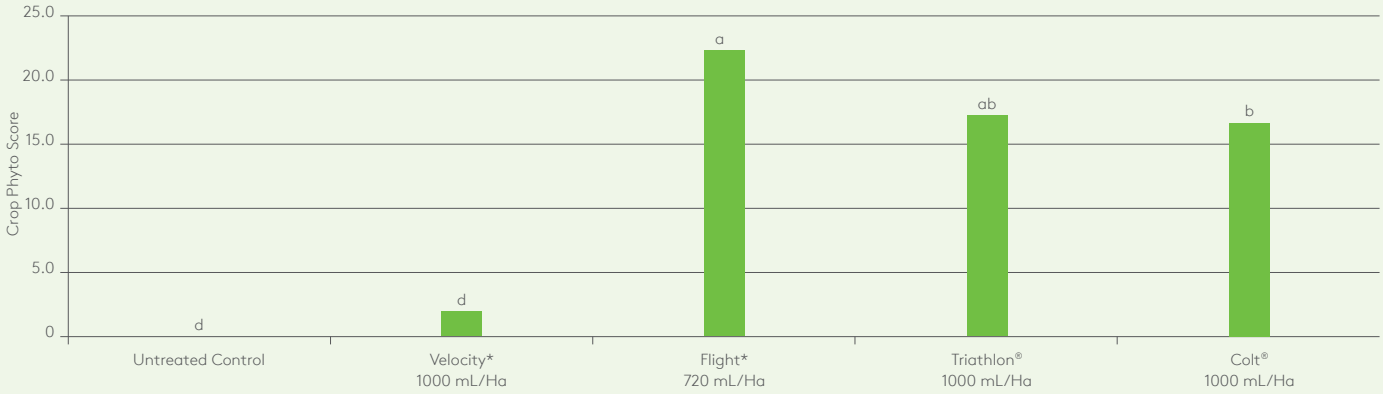
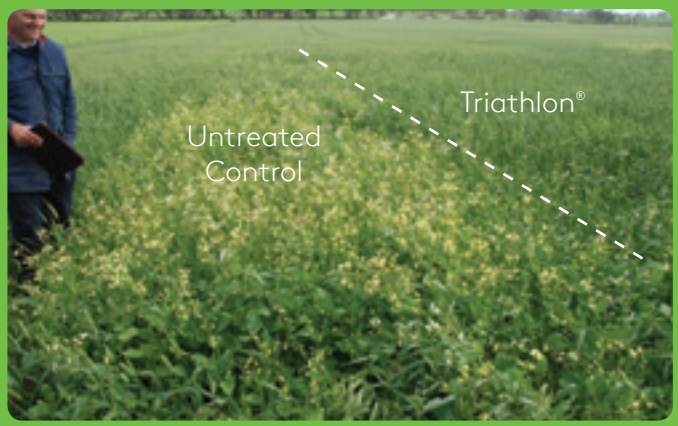


Chart 5. Means followed by same letter do not significantly differ (P = 0.05)

Triathlon® has been extensively tested for crop safety across major cereal varieties and 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 cause any lasting affect to yield. Over all of the crop safety trials conducted, the crop phytotoxicity ratings for Triathlon® were, on average, similar to that experienced with Colt® and slightly less than Flight. LSD 5 %, Agrisearch Services, 2012*



Untreated Wild Radish next to Triathlon® treated plot at Roseworthy, SA, 2013

Summary of Trial Results

The trial results indicate that when compared in the field against other market standards, Triathlon® has excellent performance across multiple weed species *(as seen in Chart 1)* and demonstrates a strong ability to control later germinating weeds when used at higher rates *(as shown in Chart 3)*.

Trial results also indicate the robust crop safety Triathlon® exhibits when compared to the market standards *(shown in Chart 5)*.

Tank Mixture Compatibility

Product and maximum rate tested	Formulation	Active Constituents	Company	Physically Compatible Yes/No	Crop Safety Field Tests	Recommended Adjuvant	Comments
Alpha-Scud® Elite 240 mL/Ha	EC	100 g/L alpha-cypermethrin	Adama	Yes – 20 L/Ha	Not Tested	Not required	Not tested biologically.
Atlantis* OD 330 mL/Ha	OD	30 g/L mesosulfuron + 90 g/L mefenpyr-diethyl	Bayer Crop-Science	Yes – 20 L/Ha (with constant agitation)	Yes x 6	Wetspray® 1000 0.25%	Not recommended. Crop effects in trials were significant.
Axial* 300 mL/Ha	EC	100 g/L pinoxaden 25 g/L cloquintocet-mexyl	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	30 g/L pyroxsulam + 90 g/L cloquintocet-mexyl	Dow Agro-Sciences	Yes – 50 L/Ha	Not Tested	Wetspray® 1000 0.25%	Some increase in crop effects is likely. Use with caution.
Cycocel* 1.3 L/Ha	SC	582 g/L chlormequat chloride	Crop Care	Yes – 20 L/Ha	Not Tested	Not Required	Not tested biologically.
Dimethoate® 500 mL/Ha	EC	400 g/L dimethoate	Adama	Yes – 50 L/Ha	Not Tested	Not required	Not tested biologically.
Hotshot* 750 mL/Ha	EC	10 g/L aminopyralid 140 g/L fluroxypyr	Dow Agro-Sciences	Yes – 20 L/Ha	Yes x 2	Not Required	Not recommended. Crop effects in trials were significant.
Hussar* OD 100 mL/Ha	OD	100 g/L iodosulfuron + 300 g/L mefenpyr-diethyl	Bayer Crop-Science	Yes – 50 L/Ha	Not Tested	Wetspray® 1000 0.25%	Some increase in crop effects is likely. Use with caution.
Mandate® 125 mL/Ha	EC	240 g/L clodinafop-propargyl + 60 g/L cloquintocet-mexyl	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	750 g/L metribuzin	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	250 g/L trinexapac-ethyl	Syngenta	Yes – 20 L/Ha	Yes x 5	Not required	Normal crop shortening is observed and some light crop spotting is possible.
Pentagon® 335 mL/Ha	SC	600 g/L tralkoxydim	Adama	Yes – 20 L/Ha	Not Tested	Amplify® 1%	Not tested biologically, expect increased crop effect under cold or frosty conditions.
UAN – Flexi N* 30 L/Ha	SL	25% nitrate 25% ammonium and 50% urea	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	25% nitrate 25% ammonium and 50% urea	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	300 g/L clopyralid + 570 LVE MCPA ester	Adama	Not tested	Yes x 2	Not Required	Some minor crop affect was observed. Commercially acceptable.

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 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
- 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
- Compatibility is limited to those specific products and product manufacturers listed unless an alternative product is clearly an equivalent formulation
- Products containing varying concentrations of active constituents to those listed may not be compatible with Triathlon®
- Adverse environmental conditions such as frosts, waterlogging, drought, pests or anything else that can stress the crop can compound adverse affects to the crop and should be avoided when tank mixing Triathlon®.

**Registered Trademarks. †Moddus Evo is not yet registered.*

Resistance Management

Triathlon® contains 3 active ingredients from 3 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 regularly with a range of herbicides 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 other known effective herbicides along with non-chemical resistance management practices.

Non-chemical practices may include windrow burning, silage and hay making, spraytopping 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 known history of developing herbicide resistance such as Wild Radish in WA. Recent glasshouse trials conducted by Adelaide University highlight the effectiveness of Triathlon® on multiple herbicide resistant Wild Radish biotypes. See below.

Triathlon® delivers excellent performance on resistant Wild Radish biotypes

Pots on the left in both photos contain fully susceptible strains while the pots on the right contain multiple resistant biotypes. Triathlon® has controlled these biotypes where Legacy® MA has failed.
University of Adelaide trial, 2012

Triathlon® delivers class leading residual control of Wild Radish.

Equivalent grams active ingredient comparison. Front pots were high rates, middle pots were medium rates and back pots were the low rates. Refer to Chart 3, where the greater residual action of Triathlon® is also demonstrated in the field at Wongan Hills. Herbicide treatments were applied to pots prior to germination of weeds.
University of Adelaide trial, 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'.

WEED smart
every weed every seed
every farm every year

Frequently Asked Questions

How do I get the best results from Triathlon®?

Triathlon® can be used 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®.
For post-emergence weed control, good coverage of target weeds is important, therefore spray volumes should be at least 50 L/Ha and preferably higher to achieve maximum coverage of target weeds and exposed soil.

I currently use Velocity* and/or Precept* on resistant Wild Radish and they work really well. Why would 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 of all available MOA is advised to extend the life of existing herbicides. In addition, unlike Triathlon®, pyrasulfatole offers limited residual control, which means under high weed pressure situations, growers may be spraying twice with the same MOA. This is not a good long-term resistance management strategy.

Products with diflufenican can sometimes cause phytotoxicity. Should I be cautious with using Triathlon®?

In most situations, any leaf discolouration or crop phytotoxicity 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 rely on 2 modes of action instead of 3 making them more prone to a control failure when used on weed populations that have developed resistance to more than one herbicide MOA group.
Triathlon® contains DFF for post-emergence and residual weed control, in addition to its other 2 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.

Features	Benefits
Residual weed control	One-pass application with residual activity for up to 4 weeks
Cost effective when compared with alternative products	Improved yield through reduced early and longer term weed competition and a greater return on investment
Three active ingredients from 3 different herbicide groups	3 Modes of Action for broad spectrum activity and Resistance Management
Short grazing withholding period	Greater flexibility to graze crops in mixed farming enterprises
High level of crop safety	Confidence that crop yield will be maximised not compromised
Excellent tank mix compatibility.	Reduced need for multiple applications.

**Registered Trademarks.*

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

Summary

- Optimised formulation for Australian weeds and conditions
- Excellent activity on Wild Radish, including multiple herbicide resistant biotypes
- Excellent crop safety – extensively tested on multiple varieties and situations
- Residual control of Wild Radish for up to 4 weeks
- Compatible with a wide range of partner herbicides, insecticides and fungicides
- Excellent rotational option on Wild Radish.

Innovation Centre

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every weed every seed
every farm every year

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Triathlon

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