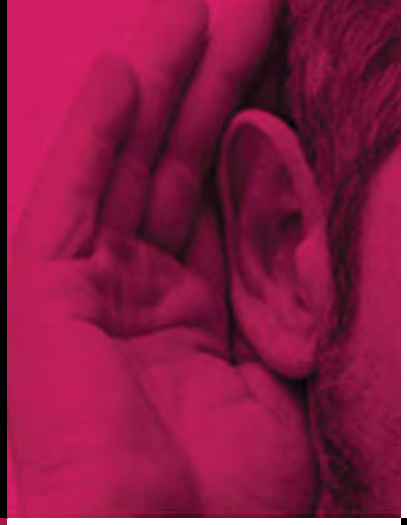
VOLATILITY VERSUS SPRAY DRIFT



GETTING YOUR SEEDING RIGHT

MIXING ORDER MATTERS

SPRAY QUALITY MATTERS

BLEACHERS BLEACH

OVERWATCH® HERBICIDE IS DIFFERENT

FOR FACTS SAKE

FMC

Notes

Features, Benefits and Label Essentials

When we see things differently, we do things differently. FMC's Overwatch® Herbicide will change the way you see your pre-emergent herbicide program. With the visual signature of magenta-coloured annual ryegrass in the field, you know Overwatch® Herbicide is working hard for you throughout the season.

When used as directed, Overwatch® Herbicide provides a good level of crop safety, operational flexibility and reliable control of annual ryegrass, bifora, sowthistle / milk thistle, wireweed, lesser loosestrife and silvergrass for up to 12 weeks after application. With FMC's Overwatch® Herbicide you will see the difference in the paddock.

Outstanding annual ryegrass control

Annual ryegrass is the most costly broadacre weed to control in Australia in terms of lost yield and the resulting revenue loss.

- Overwatch® Herbicide provides a new level of annual ryegrass control in durum wheat, canola and barley, and a comparable level of control to the current market standard in wheat.
- Excellent compatibility with a wide range of herbicides, including TrifluX# Selective Herbicide, Gesaprim# Granules and Avadex# Xtra Selective Herbicide, makes Overwatch® Herbicide ideal for broad spectrum, robust weed control and resistance management strategies.
- Overwatch® Herbicide provides up to 12 weeks of residual control.
- Due to its unique mode of action, growers will see Overwatch® Herbicide working in the field as annual ryegrass germinates, bleaches out, and dies.

Up To 12 weeks of residual weed control

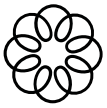
- There are many variables that contribute to persistence of weed control by pre-emergent herbicides, such as soil type and weather conditions. However, in general, growers can expect up to 12 weeks control of annual ryegrass with Overwatch® Herbicide.

Unique Group 13 herbicide (formally Group Q)

- Belonging to the isoxazolidinone chemical family, Overwatch® Herbicide's, active ingredient, Isoflex®, has a unique mode of action for control of weeds in wheat, barley and canola
- Overwatch® Herbicide has proven effective for control of annual ryegrass biotypes that have developed resistance to other modes of action.
- Overwatch® Herbicide provides an effective tool in the fight against herbicide resistance and will help prolong the useful life of currently available herbicide options.

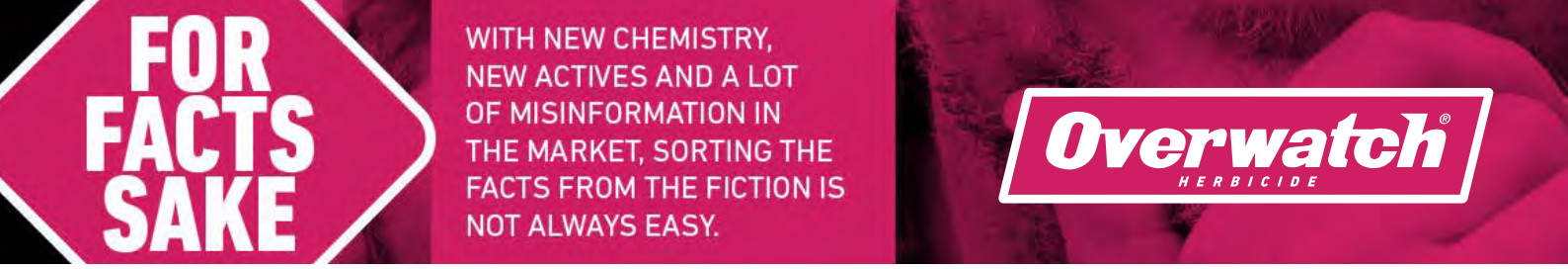
Broad spectrum activity

- Along with excellent annual ryegrass control, Overwatch® Herbicide provides long-lasting control of many other weeds including silvergrass, sowthistle, bifora, lesser loosestrife and Wireweed.
- Overwatch® Herbicide suppresses many other grass and broadleaf weeds including wild oats, brome grass and wild radish.
- With its wide spectrum of activity against both grasses and broadleaf weeds, Overwatch® Herbicide can form part of an effective integrated weed management (IWM) program by taking the pressure off other MOA herbicide groups, whilst contributing to further reducing the weed seed bank.



Outstanding agronomic flexibility

- With a nil re-cropping interval for wheat, barley and canola, Overwatch® Herbicide allows greater flexibility when poor seed germination, dry or false breaks, or pest infestations mean a block needs to be re-sown.
- When late paddock changes are needed due to a late seasonal break, lack of availability of a preferred seed variety, or changes in commodity prices, the earlier choice of an Overwatch® Herbicide application means one less problem to deal with.



Overwatch® Herbicide is different

Not all products are created equal and this also applies to today's modern pre-emergent annual ryegrass herbicides used in winter cereals. While they all provide a high level of pre-emergent control of annual ryegrass, they are all very different in how they act and behave on weeds, crops and the environment.

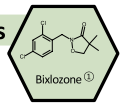
FMC's Overwatch® Herbicide will change the way you see your pre-emergent herbicide program. When you see the visual signature of magenta annual ryegrass in the paddock, you know Overwatch® Herbicide is working hard for you throughout the season. It delivers reliable control of annual ryegrass, bifora, sowthistle, wireweed and silvergrass for up to 12 weeks after application, offers operational flexibility with excellent crop safety in wheat (including durum), barley, canola, faba beans and field peas when applied as directed.

To highlight this, below are just five differences that exist between these modern pre-emergent herbicides – Boxer Gold#, Sakura#, Luximax# and Overwatch® Herbicide:

Mode of action

13 **Inhibition of Deoxy-D-Xyulose Phosphate Synthase**

Isoxazolidinones



Belonging to the isoxazolidinone chemical family, Overwatch® Herbicide's active ingredient bixlozone, branded as Isoflex®, has a unique mode of action for winter grain crops.

Overwatch® Herbicide is an inhibitor of DOXP which is involved in the synthesis of carotenoid and is classified as a Group 13 Herbicide (formerly Q). In Australia, it is the only Group 13 herbicide registered for use in any winter grain crop. Sakura# (pyroxasulfone), and Boxer Gold# (S-metolochlor + prosulfocarb) are VLCFA inhibitors and now belong to Group 15 (formerly K and J+K respectively) while Luximax# (cinmethylin), an inhibitor of fatty acid thioesterase, is a Group 30 (formerly T) mode of action herbicide. So, while Sakura and Boxer Gold act on the same pathway, Overwatch® Herbicide and Luximax act on uniquely different sites.

Big four label claims

Along with excellent annual ryegrass control, Overwatch® Herbicide provides long-lasting control of many other weeds including silvergrass, sowthistle, bifora, lesser loosestrife and wireweed.

Of the four products listed, there are differences in their registered crops and target weeds. Overwatch® Herbicide has the broadest list of weeds registered for control or suppression and is the only one registered in canola.

Label of Overwatch® Herbicide compared to industry standard pre-emergent herbicides

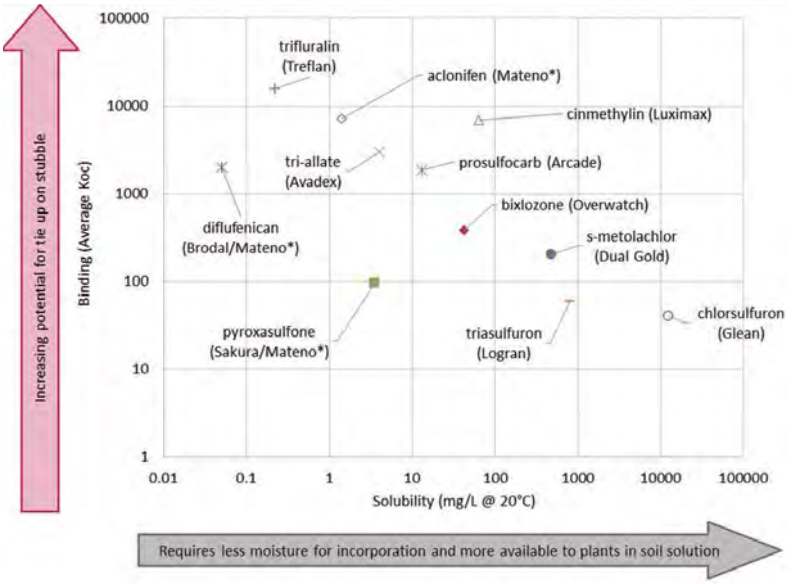
		Overwatch®	Boxer Gold#	Sakura#	Luximax#
	MOA Group	13 (Q)	15 (J) & 15 (K)	15 (K)	30 (T)
Active		Isoflex®	Prosulfocarb + S-Metolachlor	Pyroxasulfone	Cinmethylin
Registered Crops	Wheat	✓	✓	✓	✓
	Durum wheat	✓	✓		
	Barley	✓	✓		
	Canola	✓			
	Lupins		✓	✓	
	Lentils		✓	✓	
	Chickpeas		✓	✓	
	Field peas	✓	✓	✓	
	Faba beans	✓	✓		
	Triticale			✓	
Registered Weeds	Annual ryegrass	C	C	C	C
	Silvergrass	C	C	C	C
	Bifora	C			
	Sowthistle	C			
	Wireweed	C			
	Lesser loosestrife	C			
	Barley grass	S	S	C	C
	Wild oats	S		S	S
	Brome grass	S		S	S
	Phalaris	S		C	
	Bedstraw	S			
	Capeweed	S			
	Prickly lettuce	S			
	Wild radish	S			
	Stone crop		C		
	Toad rush		C	C	C

***All information is correct at the time of production 28/02/2022.*

Control C Suppression S

Adhesion to stubble

All pre-emergent herbicides vary in their binding ability to both soils and organic material. The sorption coefficient (K_{oc}) is a measure of the tendency of a chemical to bind to soils, corrected for soil organic carbon content. The lower the figure, the more mobile the chemical is in soils. Similarly, solubility measures the potential of an active to dissolve in water for movement in soil and plant uptake. With moderate binding and low water solubility, Overwatch® Herbicide washes off stubble and binds effectively to soil where it is needed.



Plant-backs

Re-cropping intervals also highlight the difference in chemistry of these modern pre-emergent herbicides. Adjacent is an example of the difference that applies to just a handful of crops that appear on the product label of these four products. Here the list of minimum re-cropping interval for several crops supported by FMC for Overwatch® are used as a reference:

Re-cropping intervals[1] (months)				
	Overwatch®	Sakura#	Boxer Gold#	Luximax#
Barley	0	9	0	9
Canola	0	9	6	9
Durum wheat	0	9	0	9
Faba beans	0	9	0	9
Chickpeas	9	9	0	9
Oats	9	9	6	9

[1] - Other factors such as rainfall and soil type can influence the minimum re-cropping interval. Consult the individual product labels for specific plant back recommendations.

The visual signature

Given the difference in chemistry it is not surprising that there are differences in how these products work in the field. After uptake of Overwatch® Herbicide, susceptible germinating plants are deprived of protective carotenoids which disrupts the plant's ability to photosynthesise. Weed seedlings that have absorbed Overwatch® Herbicide commonly emerge with a bleached and/or magenta appearance. The seedlings then rapidly desiccate over a few weeks while their seed energy store is depleted. In contrast, other pre-emergent herbicides that affect cell division of germinating plants, which limits growth, often meaning that those plants that receive a lethal dose simply don't emerge.

This highlights the importance of reading and understanding the registered label of each product before handling, applying and disposal of containers. This is to ensure you not only get the most value out of the product's application, but also that you do so in a manner that is safe to you, your crop and the environment.

For further details, visit www.overwatchherbicide.com

Bleachers bleach

Understand the mode of action of Overwatch® Herbicide

Belonging to the isoxazolidinone chemical family, Overwatch® Herbicide (active ingredient Isoflex®) has a unique Group 13 mode of action for weed control in wheat, durum, barley, canola, faba beans and field peas.

The unique Isoflex® active powering Overwatch® Herbicide works by blocking carotenoid biosynthesis. After absorption, susceptible germinating weeds are deprived of protective carotenoids which disrupts their ability to photosynthesise.

Weed seedlings that have absorbed Overwatch® Herbicide commonly emerge with a bleached and/or magenta appearance. This visual signature of Overwatch® Herbicide is most evident in annual ryegrass and wireweed. The affected seedlings then rapidly desiccate over a few weeks when their seed energy store is depleted.

For all crops treated with pre-emergent herbicides, there may be some risk of interim crop phytotoxicity. In most situations, phytotoxicity is expressed as transient bleaching of the older leaves. Bleaching is a generic term used to describe chlorosis of the leaf, where the leaf colour changes from green (normal) to a lighter shade. Bleaching can be complete (whole leaf) or partial (leaf margins, veins or leaf mid-rib). Bleaching is not unique to Overwatch® Herbicide and is caused by multiple herbicide modes of action used in the same crops Overwatch® Herbicide holds registration. Bleaching can be irreversible, or transient in nature. In the case of Overwatch® Herbicide, bleaching is transient under good growing conditions.

Photo of a barley crop showing transient bleaching

Photo of recovered barley crop

Overwatch® Herbicide is not the only herbicide that has potential to show transient bleaching. GROUP 27 (formerly H), known as the HPPD inhibitors such as Velocity#, Callisto# or Balance# as well as the Group 12 (formerly F) Herbicides, referred to as the PDS inhibitors such as Brodal# Options, Jaguar# and Sniper# can exhibit similar transient bleaching symptoms in their label approved crops.

Bleaching with the pre-emergent herbicides identified thus far most often occurs as a result of the seed coming into contact with treated soil. In the case of Overwatch® Herbicide this is when seedlings germinate within 3 cm of treated soil. This can occur as a result of the seeding process (e.g. sowing too shallow or travelling at a speed which results in excessive soil throw), the seeding system (e.g. knifepoints with splitter boots placing the seed on the furrow wall), through conditions outside other use parameters of the product as stated on the label such as environmental conditions (e.g. heavy rainfall or strong winds soon after planting), paddock condition (e.g. heavy stubble load providing > 50% ground cover) and soil condition or type (e.g. compacted soils resulting in shallow seeding depth).

Crop bleaching caused by travelling too fast during sowing resulting in excessive soil throw

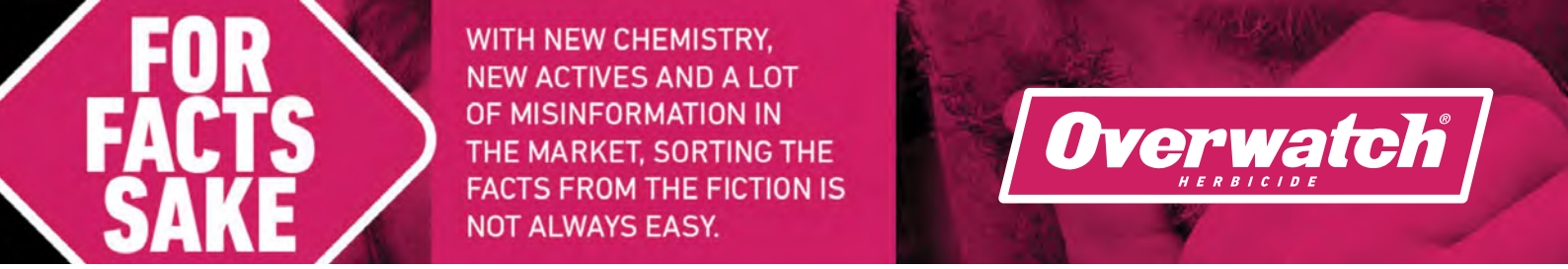
Management of Overwatch® Herbicide treated crops.

It is important to maintain good agronomic crop management to ensure the crop will be able to achieve its best yield potential. When early transient bleaching from Overwatch® Herbicide does occur, ensure the crop is monitored for pests and disease and implementing appropriate control measures without delay. Delaying the application of post emergent treatments for weeds, pests and diseases, as a result of the perception that the impact of transient bleaching may lead to slower recovery of the crop, or that bleached crop have a reduced requirement for nutrients, is NOT advised.

Bleached crops have the same requirements at critical crop development stages as non-bleached crops and weed, insect and disease controls are time dependant. Delays in the application of these controls will reduce product efficacy, cost efficiency and crop recovery, all leading to a reduced yield potential.

Maintaining the nutritional requirements of the crop is also imperative and may also assist the crop to move through the transient bleaching more quickly to reach its yield potential.

For further details, visit www.overwatchherbicide.com



Overwatch® Herbicide – volatility versus spray drift

Every compound is volatile to some degree, it's just the rate that varies. In this context, the key question for bixlozone is "does enough of it volatilise to travel a sufficient distance to impact on neighbouring crops, pastures and other vegetation?"

Bixlozone, the active ingredient in Overwatch® Herbicide, is considered to be a low volatility chemical and that means that it does not volatilise sufficiently to impact on neighbouring crops, pastures and other vegetation.

Long distance effects from bixlozone are far more likely to arise from spray drift during application.

The science of volatility

So how do you measure whether a chemical is volatile?

There is much more to volatility than just a compound's vapour pressure. The vapour pressure only describes the tendency of an individual molecule in a liquid or solid, in the absence of any other physical binding, to lift off into the surrounding air. The vapour pressure itself is affected by temperature and how crowded the space over the liquid or solid already is with previously evaporated molecules. The vapour pressure is only relevant in a laboratory and does not consider other factors in a field situation.

A much more practical measure of an active ingredient is its volatility flux (VF) from a soil surface. VF combines water solubility, binding constants, concentration, and vapour pressure. In other words, the anchors that weigh the chemical down, as well as the vapour pressure.

The VF rate value represents the mass of chemical (in µg) lost from 1m^2 of soil each second.

$$flux = e^{(0.8688R+21.535)} / 3600$$

$$R = ln\left(\frac{vp \times AR}{sol \times k_{oc}}\right)$$

Flux	Flux rate (µg/m^2-s)
vp	Vapour pressure (Pa)
AR	Application rate (lb/ac)
Sol	Water solubility (mg/L)
K_{oc}	Soil sorption coefficient (mL/g)

Volatility flux comparisons

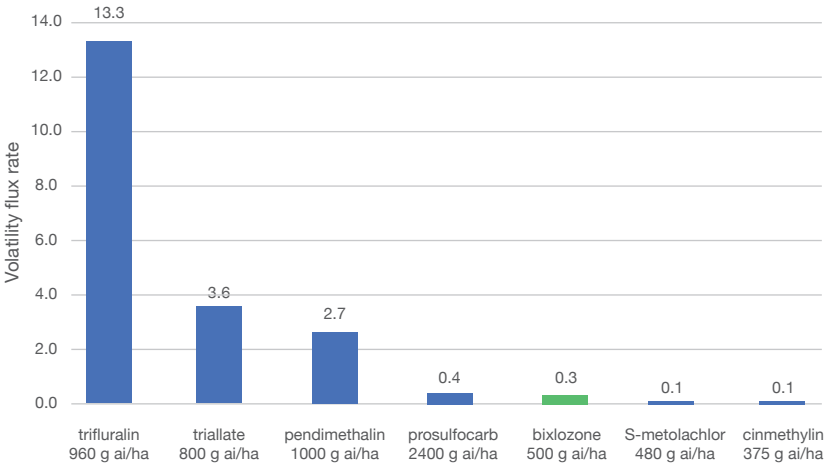
Bixlozone has a much lower VF than many other pre-emergent chemicals with a long history in the Australian market such as trifluralin, triallate, pendimethalin and prosulfocarb.

Bixlozone's K_{oc} has been measured across a wide variety of soil types and its resultant VF does not vary by much.

Since VF is dependent on soil type, FMC has determined the K_{oc} of bixlozone in a number of representative soil types from clays to sands. The organic carbon ranged from 2.1% down to 0.3% and the sand content up to 94%. The effect of these various K_{oc}'s on bixlozone's VF is minor showing that sandy soils with low organic content will not result in measurably more bixlozone volatilisation.

The VF equation can also be used to show that excess tank mixed chemicals - of any type - should NOT be dumped in an open area without taking steps to seal or destroy them. Dumping is akin to applying an extreme application rate and will ensure that a lot more chemical than the normal use pattern generates, will volatilise.

Volatility flux rate of pre-emergent herbicides



Unequivocal volatility test result

FMC commissioned a volatility flux study at RLP AgroScience GmbH, Neustadt Germany in 2016. This independent organisation uses a large external wind tunnel facility specifically designed to comprehensively assess the movement of agrochemicals from a 100m^2 characterised soil plot (1% TOC; 46% sand;16% clay).

After application of bixlozone at 300 g ai/ha to the moistened soil, a large bank of industrial fans behind applied a constant wind of 7 km/h over the unincorporated soil for 96h at a temperature of 20^{o}C.

This wind condition is very similar to a surface temperature inversion under which drainage winds of this speed can exist for many hours overnight.

The constant wind does not allow loss to vertical dilution and the tunnel prevents evaporation to the atmosphere.

The testing scenario is considered worst case for movement of soil applied herbicides.

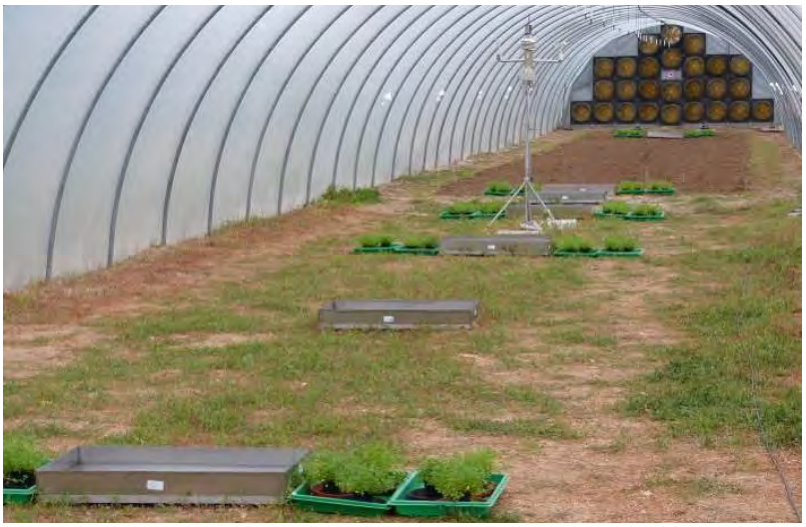
The movement of bixlozone from the soil plot was assessed using sampling trays and sensitive plants (chickweed) placed 1, 3, 5, 10, 15 and 20 m downwind. A sampling point was also set up 1m behind the soil plot (closest to the bank of fans in the picture to the right).

A maximum 0.42% applied dose (1.3 g/ha*) was detected at 1 m from the application site during the trial. Only 0.03% was detected 20m downwind. Movement was confined to the first 48 hours and unsurprisingly, no bixlozone was detected upwind of the soil plot. Chickweed bleaching was only seen at 1 m and then only rated as 13%.

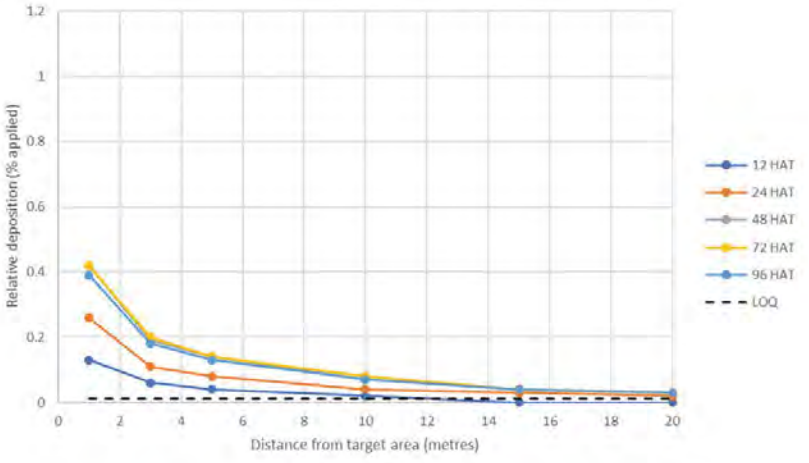
Experimentally determining bixlozone's downwind volatility deposition curves from this soil of known chemical composition, and with bixlozone's K_{oc} known in this soil, means it is possible to project the results to other soil types with different properties.

The result is that bixlozone's downwind volatility deposition curves change very little from soil type to soil type.

** FMC's 2021 lupin sensitivity field trials conducted at 6 sites around Australia showed that bleaching becomes just visible at around 1 g ai/ha.*



Downwind deposition of bixlozone due to volatility.



Local field trial confirmation of volatility flux testing

Results of Australian field trials in 2021, were consistent with the volatility flux study at RLP AgroScience GmbH, Neustadt Germany in 2016.

In Western Australian field trials, 6 m diameter circular areas in an established lupin crop were hand cleared to bare soil. To prevent direct application spray drift from confounding the results, a protective mesh barrier was erected around the circumference before the 10x label rate (12.5 L/ha) Overwatch® Herbicide was applied to the soil with streaming nozzles. Rake incorporation was delayed for 22 hours after which the mesh barriers were removed and the effect on the lupins around the circumference was monitored for 32 days.

With the minimum lupin visual response sensitivity of 1-2 g/ha in mind, and noting this trial used a 10X label rate, visible symptoms were limited to about 3 m distance downwind on the prevailing wind of the first few days. With overnight inversions taking place, the prevailing wind gave way to drainage winds at ground level which travelled in a different direction. However, only a very minor visual effect was seen to about 0.5 m in the opposite direction.

Together, the VF calculations, wind tunnel and field trials show unequivocally that bixlozone has low volatility at a practical level when used at label rates.

Chemical volatility cannot explain long range bleaching of neighbouring crops.

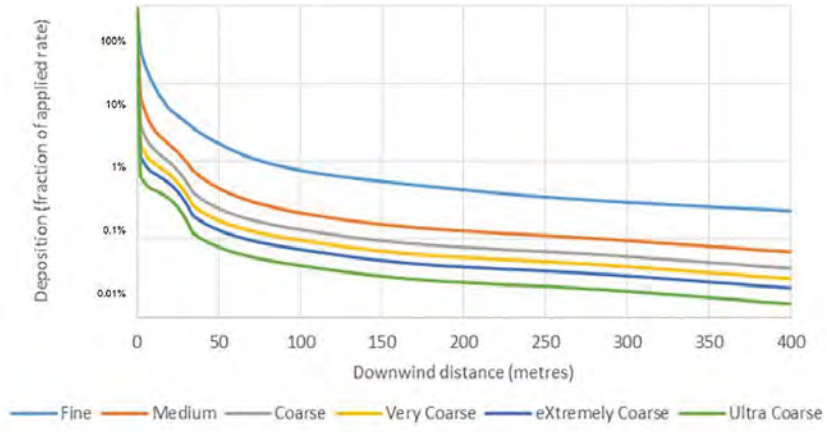
The far more likely explanation for long range visual symptoms is spray drift from the boom application.

How far "fine" spray droplets can move

The APVMA uses a field validated drift model to determine how far downwind the various spray qualities (fine/ medium/ coarse, etc.) deposit chemical under different wind speeds and from boom release heights between 0.5 and 1.0 m.

Using the sensitivity threshold value of about 0.4% of Overwatch® Herbicide label rate, the models show that a downwind visual effect on lupins could be expected out to 34 m from the site of application in a 20 km/h wind, from a boom release height of 0.5 m using a coarse spray quality. Wind speeds between 7 and 20 km/h were of little consequence – if the above had occurred in a 7 km/h wind (non-inversion conditions only) then the bleaching zone would decline by only 4 m.

Standard deposition curves for boom sprayers



The models also show that if the applicator strays from the Overwatch® Herbicide label application recommendations, then a visual effect on lupins could be expected over much greater distances – using a coarse spray quality in a 7 km/h wind but raising the boom to 1.2 m above the false target, lupins out to 120 m downwind could show bleaching effects. If this was done using a medium or even fine spray quality, then this distance could increase to 200 and >400 m, respectively. It is important to note that this modelling is performed using good spraying conditions. In a surface temperature inversion, droplets finer than 150 µm will stay aloft in the lateral winds and move parallel to the ground for hours until the inversion breaks – potentially having travelled kilometres from where they were sprayed.

Field observations

The propensity of lupins to respond visually to bixlozone at very low doses can lead to the presence of symptoms from other herbicides in the same spray tank being overlooked.

In the adjacent image, the lupins show drifted paraquat spotting as well as bleaching from bixlozone. Paraquat spotting won't be seen as far into the lupin crop as bixlozone, since a higher dose of paraquat is needed to cause spotting. The paraquat symptoms fade closer to the site of application than bixlozone's bleaching symptoms.

Lupins affected by spray drift movement may also display apparent block-wide bleaching initially lacking the gradient expected from spray drift. Again, this is because of their sensitivity. During recovery, the gradient appearance establishes as the bleaching dissipates first in plants further away, those having received less drift in the first place.

Nozzles

All spray boom nozzles produce fine droplets – those small enough to remain airborne under their own weight – usually designated as being finer than a 150 µm diameter. With a boom height of 1m or higher, droplets up to 200 µm become a high drift risk. Typically, the volume up to 200 µm size is about double that up to 150 µm.

It is important to be very aware of what nozzle you are using and its actual spray quality. Some tank mixes can 'fine-up' the spray quality by up to two categories. However, this effect is not typical of suspension concentrate formulations like Overwatch® Herbicide.

Nozzle spray quality (ASABE 572.1)	Typical % fines < 152 µm (v/v)
Fine	24-60%
Medium	10-24%
Coarse	6-10%
Very Coarse	3-6%
Extremely Coarse	1-3%
Ultra-Coarse	0-1%

Drift reducing adjuvants

There are many adjuvant products on the market with claims of general drift reduction capabilities (DRAs). However, it is exceedingly unlikely that such products have the desired effect in all situations. The effect of an adjuvant can vary greatly depending on the formulations and their rate in the tank mix, nozzle type and size and nozzle pressure. It is important that the DRA be proven to be effective in the set-up and tank mix you intend to use it. In January 2022 FMC undertook extensive testing at the Gatton CPAS wind tunnel facility with On Coarse® DRA to identify a range of nozzles capable of applying Overwatch® Herbicide as recommended. The results of this work will help in fine tuning future spray application recommendations for Overwatch® Herbicide solo and in tank mixtures with compatible herbicides applied at the same time.

Conclusion

The low volatility of Bixlozone does not account for long range off-target movement from soil. Long range movement is far more likely to occur from spray drift originating directly from the spray application process, aggravated by surface temperature inversions.

Recommendations for applying Overwatch® Herbicide

- **Apply with a coarse spray quality** as a minimum using a boom height of 0.5 m above the false target (stubble or the bare soil).
- **If equipment limitations or other circumstances prevent using this boom height**, then use a very coarse spray up to 0.75 m or an ultra-coarse spray quality above this height.
- **Set a modest upper travel speed (<20 km/h**) to minimise boom bounce, turbulence and risk of fine droplet detrainment from the spray fan.
- **Monitor the wind speed and direction frequently** at the site of application (every 20 mins at least). Spraying large blocks can take several hours and the wind speed will change over time and can be different in different parts of the block. The output from a weather station 10 km away, 3 days later is not useful.
- **Be alert for becalmed conditions in what otherwise may appear to be good spraying conditions.** The wind may pick up from a different direction taking airborne fine droplets in an unintended direction.
- **Be alert for the signs of an inversion forming.** Stop spraying immediately if the wind suddenly dies in the afternoon, trailing dust is not dissipating readily, or you feel the ground cooler than the air just above it. Commencing spraying in good conditions does not mean those conditions will continue until you finish spraying the tank load. Do not commence spraying before the inversion has broken in the morning (constant wind speed above 5 km/h).

For further details, visit **www.overwatchherbicide.com**

Spray Quality Matters

Accurate placement and uniform coverage from the spray application are the most critical objectives when applying any pesticide. It is important to have your spray equipment accurately setup and calibrated. In the case of herbicides, significant losses can occur from poor application, ranging from reduced weed control through to off-target drift or in-crop injury, MRL exceedance and extended plant-back impacting future crop choice. There is also the very serious risk of drift impacting adjacent crops, pasture and the environment. These risks can all be avoided by spending time ensuring the boom spray is set up correctly for each situation before proceeding to fill up the spray tank.

Before starting always ensure the sprayer has been thoroughly cleaned, using a suitable tank cleaner as directed. Defer to the most rigorous cleanout procedure if tank mixing with a partner, or if uncertain of what may have been in the sprayer prior to the next application.

In the case of Overwatch® Herbicide the most preferred application set-up is:

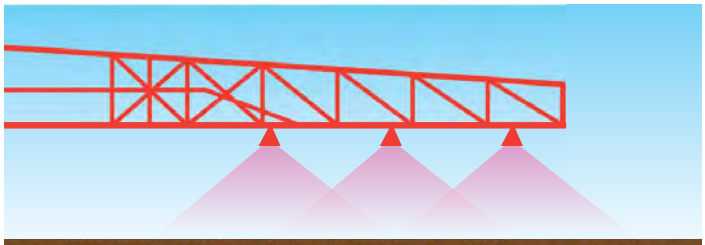
Nozzles
Nozzles that produce at least COARSE spray quality (e.g. TeeJet AIXR02 nozzles at 3 bar) operated within their optimum pressure range and angled backwards to the direction of travel to reduce horizontal movement.

Image courtesy of Teejet

Filters
Both in-line and nozzle filters should not be finer than 50 μm (50 mesh) and ideally should be both of the same size (both 50 mesh).

Images courtesy of Teejet

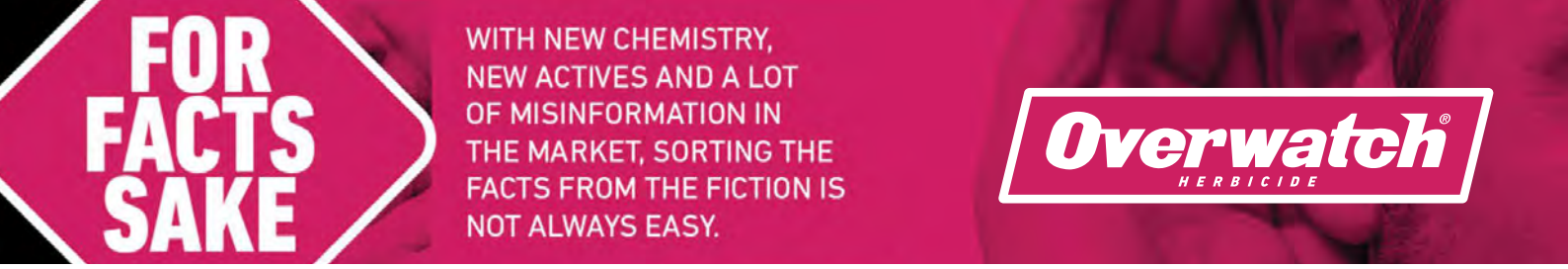
Boom Height
Set the boom at the minimum height above the target, preferably 0.5m, to achieve a double overlap of the spray on the target and to minimise the loss of herbicide through drift. Nozzle spacings should be between 25cm to 50cm.



Correct boom height above the target to achieve a double overlap of the spray.

Water Volume
Apply with a minimum spray application volume of 60 L/ha on bare soil; 80 L/ha in light standing stubble and 100 L/ha in heavy stubble situations. Include a drift reducing adjuvant in the tank mix (at label rates) to further minimise fine droplet production and enhance soil deposition in standing stubble. Coarser droplets are more likely to reach the soil in standing stubble.

Spraying Speed
Excessive travel speed affects the turbulence behind the sprayer, increasing opportunity for drift of fine droplets. For this reason, a maximum travel speed of 20 km/hr, but more preferably 16 km/hr is advised.



Mixing Order Matters:

Slow down and get your mixing order right to save serious frustration later on.

To ensure successful tank mixing and application, it is important to use correct mixing order, follow sound mixing practices and avoid over filtering. If the intended tank mix partner is not shown on the product label, carefully perform a compatibility jar test to help determine any potential physical incompatibility OR compatibility issues before mixing at full scale. This is particularly important when the tank mix consists of more than two products.

Top tips for mixing and compatibility

- **Take your time and BE PATIENT.** Many incompatibility issues and mixing problems are caused simply by rushing the process. Trying to add all your products into the spray tank before it fills should not be your objective when undertaking complex mixes.
  - Fill the spray tank to 70% of its capacity with water before introducing any products. Starting with more water will increase the chance of a successful tankmix.
  - Allow enough time for products to fully disperse in the tank before adding the next product.
  - Effective agitation when filling, in transit and spraying is critical as it improves compatibility and prevents settling.
  - FMC recommends using a spray volume of no less than 80L/ha.
- **Over filtering may cause sprayline blockages**
  Check the recommended in-line filtration is appropriate for the nozzle being used.
- **Simplify the mix.**
  - The complexity of the chemistry and potential for mixing issues increases with each additional component.
- **Only ever add one product at a time when filling. Always add products to water. Never add neat products together.**
- **Not all products are created equal:**
  - There are minor (and sometimes major) differences between formulations of products with the same active ingredient.
  - Overwatch® Herbicide is not physically compatible with most High-load glyphosate formulations present as the potassium salt.
  - FMC recommends using quality products from reputable manufacturers.
  - Understand the formulation types of each product being mixed and adhere to mixing order recommendations as described in the table below.
- **When Overwatch® Herbicide is applied in conjunction with other herbicides refer to label for further details.**
  It is the responsibility of the end-user to understand all risks associated with using other herbicides in a tank-mix with Overwatch® Herbicide. Ensure that all precautions on the label of the tank mix partner are closely followed.

Recommended mixing order

Step	Mixing Sequence	Product examples	Tips
1	Clean tank and flush lines as per the most rigorous cleaning method stated on previous mix products label		The residual product in lines may be enough to cause antagonism, resulting in filter blockages
2	Fill tank to 70% capacity with good agitation		Use best available water source and maintain tank agitation when filling
3	Add water conditioners	Ammonium sulphate	Avoid oil based products
4	Add Water Dispersible Granules (WG) or Dry flowable products (DF)	Rustler® 900 WG, Sharpen#, Sakura# 850 WG, Simanex# WG, Atrazine 900 WG	Add slowly and fully disperse granules before adding the next product
5	Flowable or Suspension Concentrates (SC)	Overwatch® Herbicide, Rustler® SC	Add slowly to tank
6	Emulsifiable Concentrates (EC)	Hammer®, Trifluralin, Tri-allate, Dual Gold#, Boxer Gold#, Countdown#	Add slowly. Solvent based products still require time to fully disperse in the tank
7	Fill tank to 90% capacity with good agitation		
8	Water Soluble Concentrates (SL)	Gladiator# CT, Paraquat, Amicide# Advance, Spray.Seed#	It is critical to add these products only when all other products are fully dispersed in the tank
9	Surfactants and oils	Parachute®, BS1000#, Uptake#	
10	Fill tank to 100% and maintain good agitation		Do not allow mixtures to settle or stand for prolonged periods

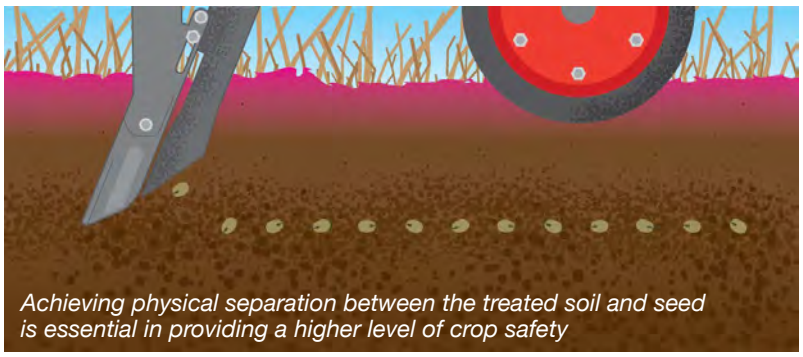
Getting your seeding right

Modern pre-emergent herbicides for weed control in cereals and canola often have specific requirements to ensure they not only provide a high level of consistent residual control but are also applied in a manner that ensures optimal crop, user and environmental safety.

This guide will help ensure you get the best out of Overwatch® Herbicide as well as many other pre-emergent herbicides:

Seeding equipment

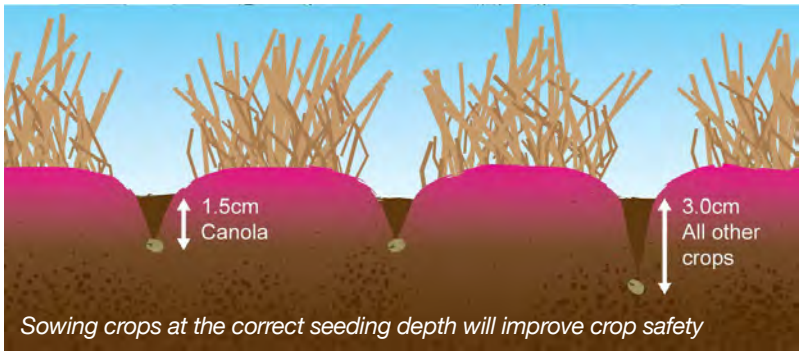
Sowing with knife point tynes and press wheels is regarded as the safest sowing configuration when using pre-emergent herbicides including Overwatch® Herbicide. Crop safety when using disc seeding systems is variable based on soil throw, seed placement and influence of stubble. With both barley and canola, Overwatch® Herbicide must only be applied prior to sowing and incorporated by sowing (IBS) using knife point and press-wheel equipment. A knife point tyne is defined as being a narrow point having no wings or inverted T (e.g. splitter boots).



Achieving physical separation between the treated soil and seed is essential in providing a higher level of crop safety

Seeding depth

Having applied Overwatch® Herbicide prior to sowing, sow canola at an ideal depth of 1.5 cm and all other registered crops at a minimum 3 cm depth below the soil surface. As with most pre-emergent herbicides, physical separation of seed from treated soil is a key factor in providing a higher level of crop selectivity. Sowing at these seeding depths will maximise crop safety.



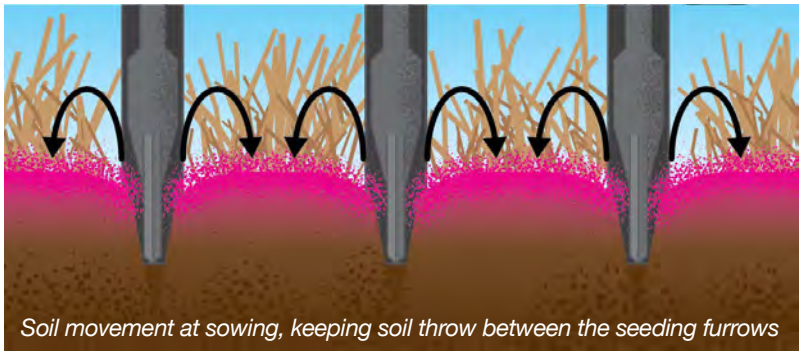
Sowing crops at the correct seeding depth will improve crop safety

Seeding speed

When using a knife point and press-wheel planter, adjust working speed to avoid excessive soil throw into the adjacent seeding row.

Throwing treated soil into the seeding row will compromise crop selectivity as the herbicide is now in closer proximity to the seed.

Selecting appropriate seeding speed will depend on soil type, soil moisture, row spacing and seeding depth.



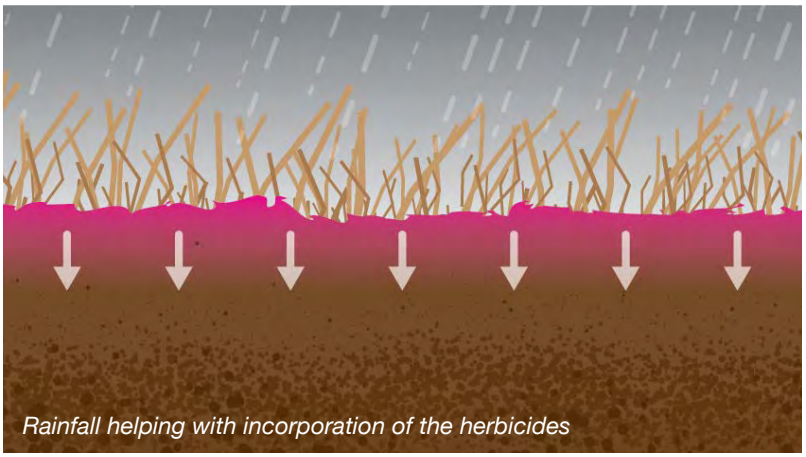
Soil movement at sowing, keeping soil throw between the seeding furrows

Rainfall timing

Overwatch® Herbicide is most effective when applied evenly to moist soils just prior to incorporation by sowing (IBS).

Sufficient rainfall soon after application allows Overwatch® Herbicide to move with soil moisture into the weed's root zone thereby increasing uptake potential.

Avoid using Overwatch® Herbicide if high or heavy rainfall is expected soon after planting.



Rainfall helping with incorporation of the herbicides

Trash load

Overwatch® Herbicide does not bind tightly to organic carbon like some other pre-emergent herbicides. However, it is recommended Overwatch® Herbicide should only be applied to uncultivated paddocks with a stubble load or other ground cover of less than 50%. Application to paddocks with more than 50% trash load can not only lead to unsatisfactory weed control, it can also result in increased levels of bleaching of the emerging crop.

Stubble load that is greater than 50% ground cover

Spray coverage

Ensure complete and uniform spray coverage on soil. Spray coverage may be compromised where application is made to soils prone to crusting or clodding resulting in Overwatch® Herbicide not being properly incorporated into the soil. This may result in reduced weed control, especially in the sowing furrow.

Correct boom height and use of coarse quality droplets will increase the chance of droplets reaching the ground.

A knockdown herbicide should always be used to control emerged weeds.

Cloddy soil

For further details, visit www.overwatchherbicide.com

This guide is not a substitute for reading the product label. Always read the label before use. Additional technical information for Overwatch® Herbicide can be found at **www.overwatchherbicide.com**

For further details, contact your local FMC representative

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*Llewellyn RS, Ronning D, Ouzman J, Walker S, Mayfield A and Clarke M (2016.) Impact of Weeds on Australian Grain Production: the cost of weeds to Australian grain growers and the adoption of weed management and tillage practices. Report for GRDC. CSIRO, Australia.

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