

## New pre-emergent herbicides – how are they performing?

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### Key words

crop safety, pre-emergent herbicide, solubility, annual ryegrass, dry sowing

### Take home messages

- Understanding the properties of pre-emergent herbicides and soil types is essential for the effective use of pre-emergent herbicides
- Crop damage most often occurs in soil types with low organic matter or where the herbicides are not adequately separated from the crop seed
- Less soluble pre-emergent herbicides are generally safer to use for dry sowing

### Understanding pre-emergent herbicide behaviour

Annual ryegrass control is becoming increasingly reliant on pre-emergent herbicides due to the increasing frequency of resistance to post-emergent herbicides. Pre-emergent herbicides are more complex to use compared to post-emergent herbicides. There are a number of factors that need consideration for successful use of pre-emergent herbicides. These include: behaviour of the herbicide, soil type and organic matter content, rainfall patterns prior to and after application of the herbicide, seeding system and crop tolerance.

Table 1 provides the relative behaviour of recently registered pre-emergent herbicides and compares the newer products to existing products. The key factors are water solubility and binding to soil ( $K_{oc}$ ). The more soluble a herbicide is, the further it will move through the soil with each rainfall event. On the other hand, higher binding to soil components will reduce herbicide movement.

**Table 1.** Behaviour of some pre-emergent herbicides used for grass weed control

Pre-emergent herbicide	Trade name	Solubility (mg L <sup>-1</sup> )		$K_{oc}$ (mL g <sup>-1</sup> )	
Carbetamide	Ultro®	3270	Very high	88.6	Medium
S-Metolachlor	Dual Gold®, Boxer Gold®*	480	High	226	Medium
Metazachlor	Tenet®	450	High	45	Low
Cinmethylin	Luximax®	63	Medium	300	Medium
Bixlozone	Overwatch®	42	Medium	400	Medium
Prosulfocarb	Arcade®, Boxer Gold®*	13	Low	2000	High
Propyzamide	Edge®	9	Low	840	High
Triallate	Avadex® Xtra	4.1	Low	3000	High
Pyroxasulfone	Sakura®, Mateno® Complete*	3.5	Low	223	Medium
Aclonifen	Mateno® Complete*	1.4	Low	7126	High
Trifluralin	TriflurX®	0.2	Very low	15,800	Very high

\*Boxer Gold contains both prosulfocarb and S-metolachlor, Mateno Complete contains aclonifen, pyroxasulfone and diflufenican

Solubility and binding need to be considered in relation to soil type and rainfall events. All herbicides will tend to move further in soils with a high sand content, due to the larger gaps between the soil particles. The main soil component responsible for herbicide binding is organic matter. Herbicides will bind less to soils with low organic matter and will be more mobile.

Rainfall is a key factor in herbicide performance. Low rainfall after herbicide application will not activate the less soluble herbicides, while high rainfall after application can move the more soluble herbicides further into the soil, resulting in crop damage. Whether the soil is dry or contains moisture at application will also influence herbicide movement. Herbicide movement through the soil will always be greater for a given rainfall size, regardless of herbicide solubility, if the soil is dry compared to a soil with moisture in the top few cm. Differences in environment between years means that pre-emergent herbicide efficacy and crop safety can vary.

Inherent crop tolerance is the ability of the crop to tolerate the herbicide if the herbicide reaches the crop seed, roots or coleoptile. Crop tolerance to pre-emergent herbicides is improved through the use of knife-point, press-wheel seeding systems that throw herbicide treated soil out of the crop row and onto the inter-row. The less inherent tolerance a crop has, the more important it is to keep the herbicide away from the crop seed. Where soil types or environmental conditions provide a greater risk of crop damage, sowing the crop deeper may mitigate some of the risk. Where a rate range is available on the label, using the lower rate in lighter soil types or higher risk situations can also reduce crop damage. Crop competition is an important component of effective pre-emergent herbicide performance. The crop will reduce seed set of survivors and later emerging weeds. Therefore, damaging the crop with pre-emergent herbicides to obtain extra weed control can be counterproductive.

## **New pre-emergent herbicide registrations and characteristics**

### ***Carbetamide (Ultero®) Group 23***

This herbicide provides grass weed control in pulse crops. Despite its high solubility, most pulses (except chickpeas) have high inherent tolerance. This means there is little danger of crop damage in the tolerant pulse crops. In lighter soil types, high rainfall can move the herbicide too far and reduce the length of control provided.

### ***Cinmethylin (Luximax®) Group 30***

Luximax is registered for the control of annual ryegrass, barley grass and silver grass in wheat (not durum wheat). Its higher solubility means that it has provided high levels of control of annual ryegrass, particularly when there is less rainfall after sowing. However, moderate solubility and moderate binding to organic matter have resulted in crop damage where heavy rainfall has occurred after sowing, even on heavier soil types. Cinmethylin is safest to use when the soil profile is close to full prior to application.

### ***Bixlozone (Overwatch®) Group 13***

Overwatch is registered for control of annual ryegrass, silvergrass and some broadleaf weeds in wheat, barley, canola, field peas and faba beans. Overwatch is not as mobile as Luximax due to lower solubility and higher binding. However, in conditions when the soil is dry at application and there is heavy rainfall after sowing, crop damage can occur. Damage is greatest on barley crops, whereas other crops are more tolerant.

### ***Metazachlor (Tenet®) Group 15***

Tenet is registered for control of annual ryegrass, several other grasses and some broadleaf weeds in canola. The higher solubility of metazachlor and low binding have resulted in crop damage with the

highest label rate of Tenet, particularly where there is high rainfall after sowing. The lower rate generally provides insufficient control of annual ryegrass. In TT canola, a lower rate of Tenet can be mixed with triazine herbicides. This provides effective control of annual ryegrass with generally good crop safety. Tenet also has an early post-emergent registration mixed with clethodim. The high solubility of metazachlor means little rainfall is required to activate the herbicide. However, control of ryegrass will be best when applied at the 2-leaf stage.

***Mateno® Complete (a mixture of pyroxasulfone, aclonifen and diflufenican) Groups 15, 32 and 12***

This herbicide can be used for control of annual ryegrass and some other grass weeds in wheat (not durum wheat) and barley. When used pre-emergent, control and behaviour will be similar to Sakura as all the components have low solubility. Rainfall is required after application to activate the herbicide. The aclonifen and diflufenican components of the product will improve control of other grass weeds compared with Sakura. Mateno Complete also has an early post-emergent registration at a similar timing to Boxer Gold. This provides the opportunity to extend annual ryegrass control and to control some broadleaf weeds. The lower solubility of the herbicides in Mateno Complete compared to Boxer Gold means more rainfall after application is required to activate the herbicide. This means the early post-emergent application of Mateno Complete will be most useful in higher rainfall regions.

**What are the best products for dry sowing?**

Using pre-emergent herbicides with dry sowing is challenging as there is no way of predicting when and how much rainfall will occur at the break. A long period between sowing and getting sufficient rainfall to activate the herbicides can lead to some herbicide losses and a shorter period of persistence after the crop emerges. Of more concern is where there is a large rainfall event to start the season. As the soil is dry, large rainfall events will move the herbicides further into the soil profile, increasing the risk of crop damage.

As with all other uses of pre-emergent herbicides, soil type, soil organic matter, herbicide behaviour and seeding system need to be considered when choosing an appropriate pre-emergent herbicide. In terms of herbicide behaviour, trifluralin remains the ideal pre-emergent herbicide when dry sowing. It has low water solubility and binds tightly to organic matter (Table 1). This means it has less chance of moving far enough into the soil to cause crop damage. Herbicides with high water solubility and more mobility in soil, such as Tenet and Luximax, are not suited to dry sowing.

The other aspect of dry sowing is managing the risk of the herbicides not activating in time to control weeds. This is most likely to happen with low solubility herbicides like Sakura and Mateno Complete. A way to manage this is to mix with a herbicide that needs less rainfall to activate, such as trifluralin or Avadex® Xtra. Trifluralin requires less moisture as it works as a gas and turns into a gas on contact with water. Avadex Xtra is absorbed by the coleoptile rather than the roots, so does not need to be moved as far through the soil.

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