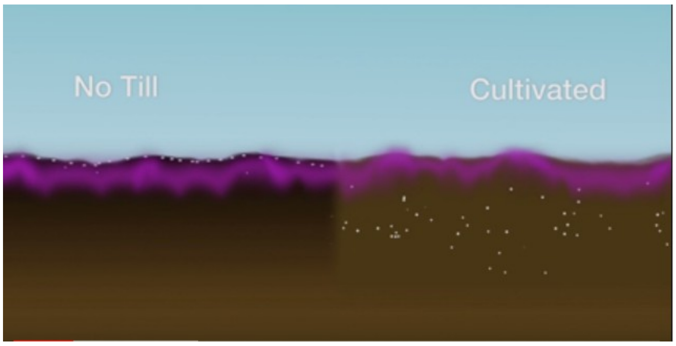
Collection Brochures Agronomiques

Edition 2018

ALGERIE: désherbage de pré-émergence des céréales.

Des avantages, mais une grande technicité requise. Témoignages de chercheurs et d'agriculteurs australiens.



En non-labour, les semences de mauvaises herbes restent positionnées en surface.

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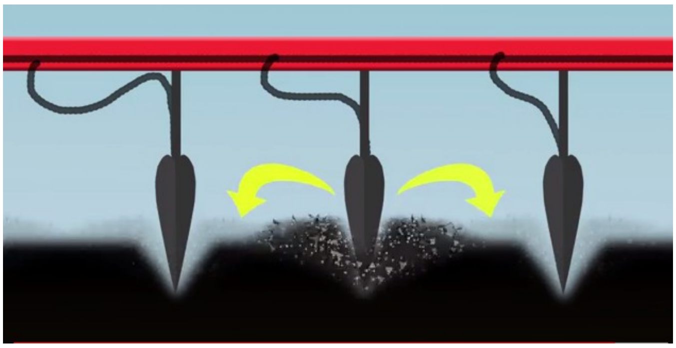
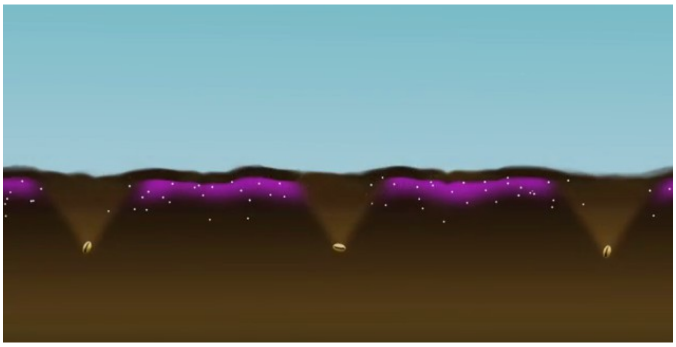
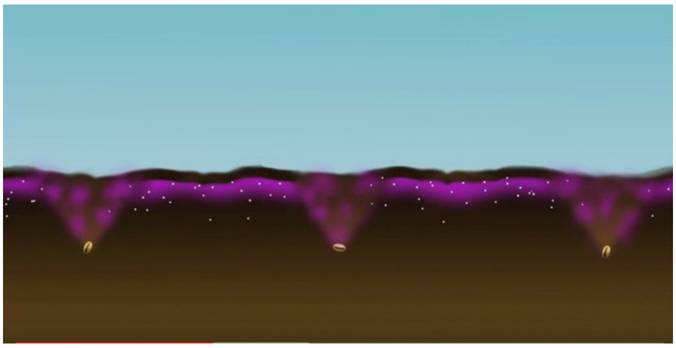
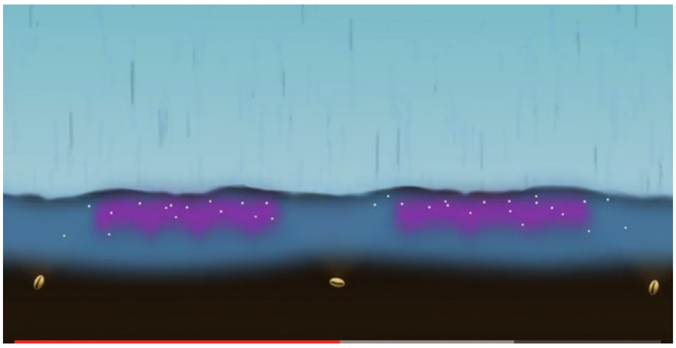
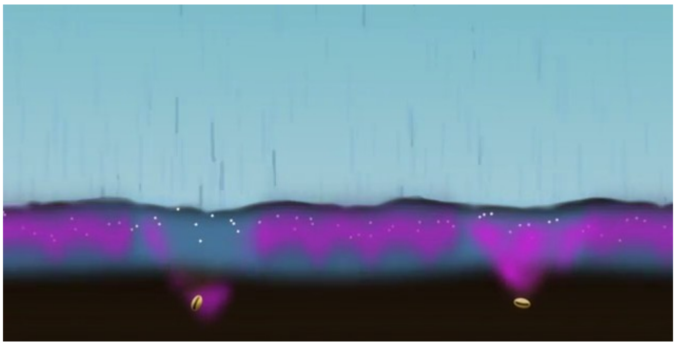
Désherbage de post-émergence avant semis du blé..

Le désherbage de pré-émergence, une opportunité à saisir en Algérie.

Djamel BELAID.

مهندس زراعي

 *Passage du semoir à petite vitesse. Pas de terre et d'herbicides projetés dans les rangs adjacents*	 *Les semences de blé ne sont pas en contact avec l'herbicide*
 *Passage du semoir à grande vitesse, de la terre et de l'herbicide est projetée sur les rayons adjacents.*	 *De l'herbicide se retrouve au dessus des semences*
 *Dès les premières pluies, l'herbicide diffuse dans le sol mais seulement dans l'inter-rang.*	 *Dès les premières pluies, l'herbicide diffuse dans l'inter-rang mais aussi dans le rang et se retrouve au contatc des semences de blé provoquant des dégats par phytotoxicité.*

AUSTRALIE

Comment procéder?

Techniques australiennes en conditions semi-arides.

SOIL BEHAVIOUR OF PRE-EMERGENT HERBICIDES IN AUSTRALIAN FARMING SYSTEMS A REFERENCE MANUAL FOR AGRONOMIC ADVISERS

Mark Congreve and John Cameron. GRDC.au

(Extraits)

RESUME **(à l'aide de "Google Traduction" traduisez en français ou arabe la partie de ce dossier écrite en anglais).**

Pour comprendre comment un herbicide en prélevée se comportera dans un système agricole, les agronomes doivent comprendre:

■ **Quelles mauvaises herbes sont dans la parcelle et où sont les graines?** Savoir ce qui se trouve dans le stock de graines de mauvaises herbes du sol et où ces graines sont situées (c'est-à-dire principalement à la surface ou distribuées dans les 10 cm supérieurs) sera important dans le choix de l'herbicide à utiliser, ce qui aidera à établir des attentes réalistes en matière de contrôle.

■ **L'herbicide est-il sujet à une volatilisation ou une photodégradation?** Sachant cela déterminera le mode d'incorporation nécessaire pour minimiser les pertes dans l'environnement.

■ **L'herbicide est-il soluble?** Cela influencera la quantité de pluie nécessaire pour son incorporation . Est-il est facilement absorbé par la mauvaise herbe en germination et la culture; est-il susceptible de se déplacer plus profondément dans le profil avec l'eau du sol (ou hors du site dans les eaux de ruissellement), causant alors des dégâts à la culture ou étant perdu par lessivage.

■ **Quel est le type de sol et le niveau de matière organique?** Les sols sableux ou à faible teneur en matière organique (faible CEC) ont peu de sites de liaison. Plus d'herbicide sera donc disponible à l'absorption par la culture et les mauvaises herbes que dans un sol à fort taux de matières organiques.

■ **De quelle façon l'herbicide se lie étroitement au sol et à la matière organique?** Les herbicides qui se lient étroitement restent à proximité de l'endroit où ils sont appliqués (sauf si des particules de sol se déplacent) et persisteront plus longtemps.

■ **Quel est le pH du sol?** Le pH affecte la persistance des herbicides persistent et leur disponibilité pour les plantes à travers leur absorption et leur liaison du sol.

■ **Quelle est la persistance de l'herbicide et comment est-il détruit?** Cela donnera une indication sur la durée de l'effet résiduel et les contraintes pour les plantes sensibles.

■ **Précipitations et températures:** Les précipitations après l'application sont importantes pour l'incorporation et pour être disponible pour l'absorption racinaire. Les précipitations et la température affectent également la dégradation.

■ **Taux d'application:** le choix du taux d'application affecte l'efficacité, la durée du résidu effectif et éventuellement et la sélectivité des cultures.

The importance of controlling weeds in broadacre field crops

Weed management is critical for profitable Australian farming systems. Weeds compete aggressively with grain crops for moisture and nutrients and if left unchecked, can result in significant crop losses.

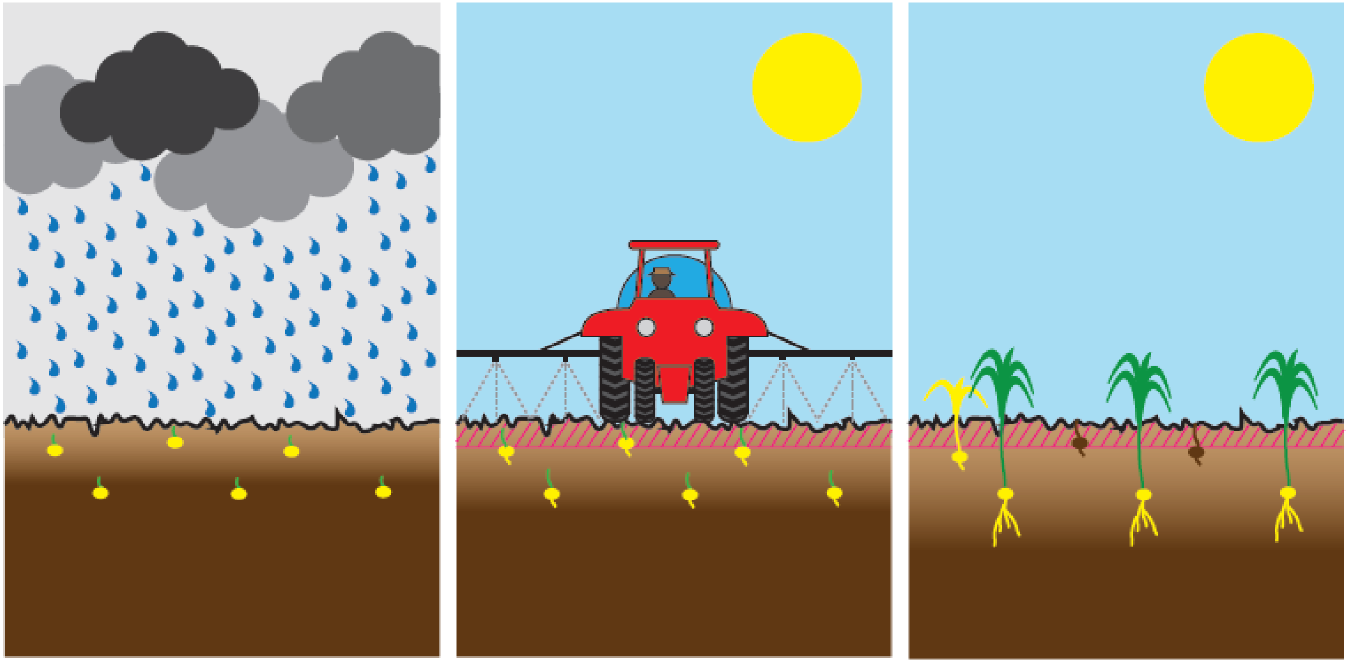
In addition to losses from competition, Australian growers spend well over $1 billion1 per year on herbicides to which the additional costs of machinery, labour and contractors to apply these herbicides must be added.

The past 25 years has seen a major revolution in broadacre farming with the majority of grain farmers adopting a minimal or zero tillage system which has largely reduced or removed the use of cultivation as a tool for weed control. Also, in many areas, there has been a trend towards growers specialising in 'cropping'. This has led to a decline or elimination of livestock from the farming system, further reducing the diversity of weed control options. The combined effect has been a significant increase in the reliance on herbicides for weed management in Australian farming systems.

This shift in farming system has seen an evolutionary change in weed species in many paddocks, with increasing dominance of surface or shallow germinating weeds that are suited to a zero tillage system where weed seeds are predominantly left undisturbed on the soil surface.

Since the adoption of reduced tillage practices, controlling weeds on the modern farm has largely become the domain of herbicides, both within the crop and in the fallow between crops. Growers have had a range of cost effective and efficacious herbicides to rely upon, however there has been a heavy reliance on a few individual modes of action, namely Groups A, B, I and M in particular.

Figure 3: Dry topsoil with inadequate soil water to allow herbicide uptake by emerging weeds – the perfect storm for weed escapes.



Rainfall stimulates weed germination in the soil.

Soil surface is drying (hatched zone). Pre-emergent herbicide applied after rain but before weed emergence. No further rain or mechanical incorporation.

With herbicide concentrated in a dry narrow band, there is little chance for plant uptake of herbicides and escapes can occur.

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PARTICULARITES

Quels avantages?

Une action précoce supérieure aux herbicides foliaires.

Particularités d'utilisation

While being quite different in their weed control spectrum and the way that they work within the plant, these herbicide groups have a number of similarities that have seen them gain popularity:

■ They provide reliable, consistent performance

■ Are frequently 'cheap' relative to other available weed control options, and

■ They work primarily as foliar applied post-emergence herbicides.

The cost effectiveness, reliability and ease of use of these herbicides, has encouraged growers to favour post emergent options, where they can wait and see which weeds emerge before dealing with the problem.

Unfortunately, evolution continues to work in our cropping systems. This has seen an increase in the importance of weeds that:

a) Are adapted to the new farming system i.e. Surface germinating and windblown weed seeds and

b) Development of individual weeds that are resistant to the herbicides previously used to control them.

A recent example of adaptation and evolution is evident in barley grass and brome grass. Continual herbicide selection pressure early in the cropping season has selected for individuals that express a high level of seed bank dormancy leading to a high percent of the population emerging later in the season and escaping early season control. This is driven by the selection of a vernalisation response (cold requirement before germination) which is under the control of a single gene.

Herbicide resistance and species shift are causing many advisers and growers to radically rethink their approach to weed management including the introduction of more diversity into their weed control programs. Increased use of preemergent herbicides is one tool that increases diversity of the weed control program while also reducing weed numbers, which will assist following tactics such as harvest weed seed management. However increased use of pre-emergent herbicides will also increase the selection pressure placed on these herbicides; underscoring the need to introduce nonherbicide based weed management tactics into the cropping system, to reduce our reliance on herbicides and thereby prolonging their useful life.

The value of pre-emergent herbicides

When devising a weed control strategy, pre-emergent herbicides can be a valuable additional tactic to help drive weed numbers down. Used alone they often do not achieve the objective of driving down weed seed bank numbers, but when used amongst a suite of tactics, they can be particularly effective.

Benefits of pre-emergent herbicides include:

■ Offers an alternate mode of action to many post-emergent options

■ Reduced selection pressure on subsequent postemergent herbicide applications

■ Removal of early season weed competitive pressure on a crop often protects crop yield better than later applied post-emergent applications, especially in weedy paddocks

■ Cost savings, especially in the fallow where multiple knockdown applications may be required

■ Reduced time pressure on other spraying operations, both in crop and in fallow

■ Major role in patch eradication where a weed blowout can be GPS logged and a pre-emergent herbicide applied to manage the patch

■ After a cultivation event, there will always be some weed seed in a position in the soil profile that is ideal for germination. Applying a pre-emergent herbicide after the last cultivation can manage these weeds that would otherwise emerge and ultimately return additional seed to the soil, and

■ Some crops have few post-emergent options (e.g. Grass weed control in sorghum, or broadleaf weed control in pulses) and hence often rely on pre-emergent herbicides for in-crop weed control.

INCONVENIENTS

Quels inconvénients?

Principales critiques faites à la pré-émergence.

Common objections to the use of pre-emergent herbicides

Many growers frequently raise objections when pre-emergent herbicides are discussed. Some of the more common objections are:

“If it doesn’t rain to germinate the weeds then my money is wasted”.

Most pre-emergent herbicides require rain for activation, although some pre-emergent herbicides can remain on a dry surface for considerable time without degradation.

Understanding the properties of the chosen herbicide assists decision making on application timing and the incorporation requirements of the molecule. Usually rainfall, or existing soil moisture, is required to germinate weeds, so the correct timing of pre-emergent herbicide application relative to rainfall and weed germination is important to maximise the value of the investment.

“I applied a pre-emergent herbicide a few years ago and it didn’t work. I can’t rely on them”.

Pre-emergent herbicides are not all the same. The properties of each herbicide dictate where it remains in the soil profile, what conditions are required to maximise performance and how quickly it will break down. As pre-emergent herbicides are strongly influenced by soil type, stubble cover, incorporation, temperature and rainfall, it is quite possible that a different result can be achieved between two adjacent paddocks with application only a few weeks apart.

It is generally much easier to monitor the performance of a post emergent application. The starting weed population is known and the herbicide effects can be seen over the resulting weeks. With pre-emergent herbicides, typically the size of untreated weed germinations is not measured via an untreated control in commercial situations. As a result, it is usually much more difficult to gauge success and impact of a pre-emergent herbicide application, than it is for a postemergent application. In situations where growers have been dissatisfied with the performance of a pre-emergent herbicide, they are often surprised if a ‘missed strip’ is found, as this demonstrates what the paddock would be like if the preemergent herbicide had not been used.

“Pre-emergent herbicides leach and move in the soil and damage off target vegetation”.

The properties of some pre-emergent herbicides allow for the product to be more available in the soil profile and more able to move with the soil water; while some other herbicides are very tightly bound and unlikely to move. Understanding herbicide properties, in particular the solubility and binding, enables the right product to be selected for the situation.

“Using pre-emergent herbicides locks me out of crop rotation options”.

This is probably the most frequent objection by growers when their adviser recommends a pre-emergent herbicide. By nature of their residual properties, most pre-emergent herbicides will have plantback constraints to some crops.

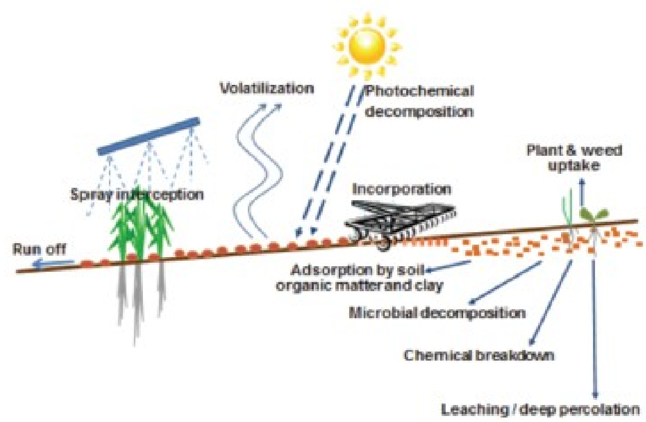
Z O O M However, it is extremely unlikely that a grower will ever apply a particular residual herbicide to the entire farm, so the ‘whole farm’ is not being locked out of a flexible crop rotation.

In practice, there are usually a percentage of paddocks where the next crop rotation is firmly locked in. In these paddocks, there is the option to select an appropriate residual herbicide with only a low risk of a negative impact on crop rotations.

When dealing with these common objections, the key underlying theme is that it is critical for advisers to have a thorough understanding of the properties of pre-emergent herbicides under consideration, to enable the best choice to be made.

CONSEILS This manual is a reference for Australian grain advisers, covering the factors influencing the performance and break down of pre-emergent herbicides.

Figure 1: Interactions, loss and breakdown pathways of soil applied herbicides.



HUMIDITE DE SOL

Tenir compte de l'humidité du sol.

Apliquer l'herbicide avant la pluie.

Humidité du sol

L'humidité libre du sol est essentielle à la performance des herbicides pré-émergents. Avec une faible quantité d'eau dans le sol, les herbicides de prélevés qui dépendent de l'absorption des racines seront moins disponibles.

Une fois dans le sol, l'herbicide établira un équilibre entre la quantité disponible dans l'eau du sol et celle se liant aux colloïdes du sol. Il faut généralement plusieurs jours pour établir cet équilibre après incorporation.

Nouveautés. Certains herbicides auront généralement une contrainte supplémentaire telle 'Ne pas irriguer' ou 'Ne pas appliquer si des précipitations de ruissellement sont attendues' dans les 2 ou 3 jours suivant l'application. Cela permet en partie de donner du temps pour que la liaison du sol ait lieu et l'équilibre soit établis.

Si l'eau du sol disponible est faible, un pourcentage plus élevé d'herbicide sera lié aux colloïdes du sol et indisponible pour l'absorption des plantes. C'est pourquoi de nombreux herbicides en prélevée peuvent ne pas permettre un bon contrôle des mauvaises herbes dans des conditions sèches.

Le scénario le plus défavorable pour l'efficacité des herbicides en prélevée est représenté ci-dessous.

CONSEILS

La solution conseillée est généralement d'appliquer l'herbicide de préemergence avant la pluie, plutôt qu' immédiatement après.

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Placement différentiel.

Si l'herbicide a des propriétés qui le retienne à la surface du sol, il peut alors être utilisé dans une situation où la culture est semée à une profondeur en dessous de la bande herbicide avec les racines des cultures dans le sol en dessous de la bande herbicide. Alors que ce peut être une stratégie efficace pour certains herbicides, les dommages aux cultures peuvent encore se produire dans des situations où l'herbicide est déplacé vers le bas dans ou en dessous de la zone des semences, en particulier si les fortes pluies se produisent notamment la première pluie d'incorporation.

Z O O M

Les dommages aux cultures sont souvent une fonction d'un ou plusieurs des éléments suivants:
-faible profondeur de semis,
-placement d'herbicides dans (ou non) la zone de culture,
-pluies très abondantes après le semis,
-sol à trop faible rétention des herbicides et /ou
- produits à haute solubilité et /ou faible liaison.

FACTEURS

Facteurs influençant l'activité des herbicides

Incorporer au plus vite les herbicides au sol.

FACTORS INFLUENCING THE ACTIVITY OF PRE-EMERGENT HERBICIDES

To understand how pre-emergent herbicides perform, it is important to know the properties of the herbicide, the soil type and how it is broken down in the environm pre-emergent herbicide is an interaction between the solubility of the herbicide; how tightly it is bound onto soil colloids and organic matter; soil factors such as structure, cation exchange capacity and pH; herbicide volatility; the environment and particularly soil water and the rate of herbicide applied.
Figure 1: Interactions, loss and breakdown pathways of soil applied herbicides.
Understanding the importance of each of these pathways will give guidance as to likely performance of the herbicide in question. However if one of these factors in the equation is extreme, then this single factor can have an overriding influence on the overall balance and can alter what normally happens in the field. For example, some herbicides are relatively insoluble and tightly bound to soil colloids which suggest that they are unlikely to leach. However, in a situation of a high initial rainfall event occurring onto a dry soil, even a herbicide with these properties may move further down the soil profile before it has the opportunity to bind to the soil. This may mean that the herbicide can move out of the zone where it is required for weed control, or into a zone where it can damage the crop.

Interactions prior to incorporation

Stubble and crop interception
Stubble or existing weed cover in a zero or reduced till fallow will intercept some of an applied pre-emergent herbicide before it reaches its target – the soil. Likewise, if the preemergent herbicide is applied as an in-crop application, a percentage of herbicide will be intercepted by the crop.
The amount of herbicide intercepted will be proportionate to the percent of ground coverage of the stubble or crop (or weeds if they are already present at application). As shown in Figure 2, while this relationship is linear it should be noted that, for example, 50% ground cover does not result in 50% capture of the herbicide on the above ground material.
Interception by standing material can have two negative effects:
a) For some products, herbicide tied up on the stubble or in the canopy may not be available for soil incorporation and subsequent weed control, and
b) Interception may lead to an uneven coverage of the soil surface, resulting in areas with insufficient herbicide coverage and potentially weed escapes.
Herbicide intercepted by standing organic material will be subject to a certain level of binding, depending on the herbicides' characteristics (see later section on binding).
Some herbicides are tightly bound and are lost to the system in terms of weed control, despite subsequent rainfall (for example trifluralin). Others are loosely bound and relatively soluble and can be returned to the soil by rainfall that 'washes' it off the organic material (for example chlorsulfuron). To understand the potential level of binding of a herbicide, advisers need to consider its binding coefficient (Kd or Koc) and solubility. However, even if a herbicide is loosely bound and available to be washed off, it still may be prone to loss due to volatility and photodegradation, before it is incorporated into the soil by rainfall.

Figure 2 : The percentage of herbicide captured by stubble or plant material in relation to the percentage of ground cover.

SOURCE: (Shaner, 2013)
Where high levels of stubble or plant material exist, the level of spray droplet interception can be minimised by adjusting how the herbicide is applied. Some techniques that can increase the proportion of herbicide reaching the soil include:
■ Wind across the rows during application
■ Use rear facing nozzles where the angle offsets the travel speed, to have droplets moving predominantly downwards through the stubble
■ Larger droplets travelling at higher speed
♦ Select a nozzle and pressure that produces larger droplets

8 SOIL BEHAVIOUR OF PRE-EMERGENT HERBICIDES IN AUSTRALIAN FARMING SYSTEMS
♦ Narrow fan angles (e.g. 65-80 degrees) increases

droplet speed

■ Keep water rates high to maintain coverage when using larger droplets by increasing the number of droplets produced.

■ Narrower nozzle spacing (25cm vs 50cm)

■ Slower travel speeds (i.e. < 16 km/h) to reduce horizontal movement (forward trajectory of droplets), and

■ Minimise boom height, but ensure at least double overlap.

In situations where pre-emergent herbicides are used in-crop, correctly set up directed sprays (layby application) are designed to reduce interception by directing the spray under / away from the crop canopy.

Where herbicides with both pre and post-emergent activity are applied in-crop, the pre-emergent activity is often better when applied during early crop growth stages, as soil coverage may be more even due to less crop interception.

Pre-emergent herbicides and windrow burning

With the advent of increasing herbicide resistance, many growers have introduced windrow burning into their integrated weed management strategy. This technique concentrates the previous year's stubble, including the chaff fraction containing the weed seeds, into a narrow band to be burnt in autumn.

If pre-emergent herbicides are used in conjunction with this technique, then consider the following points:

■ Applying pre-emergent herbicides over the top of a windrow, before it is burnt, will probably result in extremely high levels of herbicide interception and very little on the ground under the windrow. So avoid herbicide application prior to burning.

■ Always strive for a hot burn within the windrow itself.

This is important to obtain maximum mortality of the weed seeds, but also to maximise the amount of residue converted to ash and minimise the amount left as charcoal.

■ Herbicides will not generally bind tightly when sprayed onto ash. However a thick layer of ash may prevent even soil coverage, unless a rainfall event has occurred between the burning and the herbicide application, to disperse the ash.

■ Conversely, herbicides will usually bind to charcoal to an even greater extent than they do for green organic matter or stubble. So if charcoal is left after a burning event (or biochar is added to the soil) then it is likely that less herbicide will be available for weed control and herbicide performance may be compromised.

Photodegradation

Photodegradation occurs when the herbicide undergoes a chemical reaction in the presence of sunlight and is then broken down and lost to the weed control system. For most uses of pre-emergent herbicides in Australia, photodegradation is not the main path of breakdown as standard incorporation practices such as cultivation, sowing or sufficient rainfall after application, are typically adequate to prevent unacceptable levels of loss. However, when a herbicide is sprayed onto a dry soil surface or dry stubble in summer, with no following rainfall or mechanical incorporation, losses from this pathway will be at their highest.

Some of the common pre-emergent herbicides that can undergo some level of photodegradation include the Group C herbicides (atrazine, fluometuron, simazine, terbuthylazine and diuron); sulfosulfuron; pendimethalin; picloram; and s-metolachlor.

If these herbicides are applied under warm, dry conditions with no rainfall expected in the coming weeks, losses can be significant. Mechanical incorporation can be used to reduce losses to photodegradation.

Volatilisation

Some of the pre-emergent herbicides used in the Australian grains industry are considered volatile. Volatile herbicides transition to a gaseous phase after application if left on the soil surface without incorporation. Volatile herbicides must be incorporated soon after application to avoid significant loss to the atmosphere and therefore maintain their efficacy on weeds.

Loss from volatility is not an 'on/off' switch. For example, if a herbicide label indicates that the product should be "incorporated within 24 hours" this does not mean that there is no loss up until hour 23 and that it is all gone by the 25th hour.

Volatility loss commences as soon as the spray is applied, so with any volatile herbicide it is important to incorporate as soon as possible after application. The time period for incorporation on a label is the time by which the manufacturer has determined that losses may start to become unacceptably high if the product has not be incorporated within this time.

Volatility is measured in terms of vapour pressure and is usually expressed as millipascals (mPa) at 25°C. Herbicides with a vapour pressure less than 1 mPa are generally referred to as 'non-volatile', while products with a vapour pressure above 1 mPa may convert into a gaseous phase and be lost to the atmosphere, unless incorporated post application. As the vapour pressure increases, so does the urgency to have the herbicide incorporated quickly, to reduce losses.

Table1 lists a selection of common pre-emergent herbicides in order of volatility to demonstrate the range of vapour pressures.

Volatility loss commences as soon as the spray is applied, so with any volatile herbicide it is important to incorporate as soon as possible after application..

INCORPORATION

Quel mode d'incorporation au sol?

Le plus rapide pour échapper à leur vplatilisation ou photo-dégradation.

Incorporation

Without incorporation, some herbicides are more predisposed to breakdown and loss from volatilisation and/or photodegradation. Some molecules are quite volatile and significant losses from the soil surface can occur if the herbicide is not incorporated within hours or days of application. At the other extreme, some molecules have a very low vapour pressure and are not subject to photodegradation and can remain on the soil surface for days and possibly even weeks without significant loss from these pathways.

Incorporation usually takes one of four forms:

■ Full cut mechanical incorporation - prior to the advent of reduced tillage this was the major incorporation method used in Australia and involved a light to moderate mechanical cultivation, usually with harrows or offset discs. This form of incorporation works well for highly volatile products such as trifluralin and tri-allate, provided it is done within hours of the spray application.

Historically it was common to see harrows being towed directly behind the boomspray or operating in the same paddock while spray application was still underway.

■ Incorporation by sowing (also commonly referred to as IBS) - this tactic is used extensively in reduced and zero till farming systems. A knife point seeder is set up to 'throw' a small amount of treated soil out of the sowing furrow and onto the inter-row to cover the herbicide which has been previously applied to the soil surface.

Typically this will only work with seeders set up to plant on ~25 to 30cm row spacing. Careful attention to seeder set up is required to ensure even inter-row coverage while preventing throw of treated soil into the next furrow.

With some volatile herbicides (e.g. trifluralin and pendimethalin) the labelled rate for IBS application is often much higher than that used in a full cut incorporation method. A higher application rate used with these herbicides in an IBS system is possible due to:

♦ limited mixing of the treated soil which means there is greater separation between the herbicide band near the soil surface and the seed

♦ much of the herbicide above the crop row is removed and displaced into the inter-row area, and

♦ incomplete soil coverage of the herbicide which often results in greater volatility losses.

These factors reduce the potential for contact between the herbicide and the emerging crop.

■ Irrigation - if overhead irrigation is available then this can be an effective method to incorporate some herbicides. The volume of water required will depend upon the soil type, ground cover, solubility of the herbicide and the existing soil moisture. Typically a 5 to 10mm irrigation event is usually satisfactory for most situations. It is important not to over water and risk moving the herbicide down the soil profile before binding has occurred.

Other forms of irrigation i.e. furrow irrigation are not recommend for herbicide incorporation due to Table 1: Examples of vapour pressure for selected pre-emergent herbicides and summary of incorporation requirements.

Herbicide Vapour Pressure (mPa @ 25°C)^
tri-allate (Avadex®) 12
trifluralin (Treflan®) 9.5
s-metolachlor (Dual®) 3.7
dimethenamid-P (Outlook®) 2.5
pendimethalin (Stomp®) 1.94
clopyralid (Lontrel®) 1.36
prosulfocarb (Boxer® Goldp) 0.79
metribuzin (Sencor®) 0.121
terbuthylazine (Terbyne®) 0.12
imazapic (Flame®) 0.01
atrazine (Gesaprim®) 0.0039
triasulfuron (Logran®) 0.0021
simazine (Gesatop®) 0.00081
isoxaflutole (Balance®) 1.0 x 10-3
diuron (various) 1.15 x 10-3
pyroxasulfone (Sakura®) 2.4 x 10-3
diflufenican (Brodal®) 4.25 x 10-3
picloram (Tordon®) 8.0 x 10-5
chlorsulfuron (Glean®) 3.07 x 10-6

^ (University of Hertfordshire, 2006-2014) The Pesticide Properties DataBase (PPDB) developed by the Agriculture & Environment Research Unit (AERU), University of Hertfordshire. Accessed on 4th August 2014 http://sitem.herts.ac.uk/aeru/iupac/index.htmp Vapour pressure of prosulfocarb. Boxer Gold also contains s-metolachlor Actives with a vapour pressure of greater than 1 mPa are generally considered volatile and are

likely to require incorporation. Refer to individual product labels for specific situations.
Actives with a vapour pressure of less than 1 mPa are generally considered non-volatile and do not usually require any specific incorporation recommendations after application.

10 SOIL BEHAVIOUR OF PRE-EMERGENT HERBICIDES IN AUSTRALIAN FARMING SYSTEMS

unevenness of soil wetting between the start and finish of the furrow; too much irrigation water is usually applied; runoff into tail ditches; and the fact that furrow irrigation also wets along a horizontal front.

■ Rainfall is often relied on and used for incorporation, especially in fallow situations. Frequently applications will be made prior to a forecast rainfall event. As forecasts do not always eventuate, and rainfall volume can be highly variable, this practice can lead to inconsistent results.
In situations where incorporation is advisable, the objective is to move the herbicide into the top few centimetres of soil where it will be protected from UV degradation and volatilisation, yet still keeping it in the zone required for weed control (which is often close to the soil surface for shallow germinating weeds, especially in zero till systems).

Herbicide behaviour in the soil
Once a pre-emergent herbicide is in the soil, an equilibrium is established between how much is bound to clay and organic matter and is therefore less available for plant uptake; and how much is dissolved in the soil water and available for root uptake. Factors that affect the degree of binding are the soil type (structure, pH and cation exchange capacity); organic matter in the soil; the solubility of the compound; the amount of available soil moisture; and the inherent binding strength of the molecule.

Position of the herbicide in the soil
The location of targeted weed seeds is an important consideration. In a zero till environment, most weed seed is likely to be located on or near the soil surface. In a zero till system, it is most likely that pre-emergent herbicides that bind and stay relatively close to the soil surface in the zone where the weed seeds are germinating is preferred.
Conversely, if deeper germinating weeds are the target, then having a herbicide which stays tightly bound to the soil surface may allow for weeds to germinate at depth and be able to grow through the herbicide band on the soil surface.
A practical example of this would be where trifluralin is used on annual ryegrass in a no-till system. In a tilled system, ryegrass seed is spread through the soil surface to the depth of tillage. When trifluralin was applied at or prior to sowing and harrowed in, it was also mixed in this zone. This diluted the trifluralin throughout the surface zone. At the rates that could be used (crop damage was a concern as the trifluralin treated zone was often close to / just above the depth of the crop seed) weed control would often be marginal.
In modern no-till systems, weed control using trifluralin via 'incorporate by sowing' (IBS) application often results in higher levels of control than in traditional tilled systems with full incorporation. In a no-till system, ryegrass seeds are concentrated on or near the soil surface, as is the herbicide.
Higher rates can be applied as the margin for crop selectivity is larger than in a full mechanical incorporation system, as there is greater spatial separation between the soil surface where the narrow herbicide band is and the depth of the cereal seed.
Also, the herbicide over the row is displaced into the inter-row at sowing - further enhancing crop selectivity while reducing volatilisation loss of the herbicide.

Soil texture and cation exchange
The type of soil often has a significant bearing on the performance of the pre-emergent herbicide. Soil texture (the ratio of sand, silt and clay) and soil organic matter will have an effect on the binding ability of the herbicide (adsorption).
Cation exchange capacity (CEC) is used as a measure of the soils' adsorption sites where binding can occur.
Heavier clay soils and soils with higher organic matter have more binding sites (higher CEC) and can bind more herbicide.
Increased binding is likely to result in higher application rates being required to achieve a given level of weed control, as less herbicide is available in the soil water for uptake by germinating weeds. Increased binding also generally results in less leaching.
Conversely, in sandy or low organic matter (lower CEC) soils there is less binding with more herbicide likely to be available in the soil water. This may lead to increased risk of injury to crops soon after application where there is a lot of freely available herbicide in the soil water, especially for highly soluble herbicides. As a result, many labels recommend a lower application rate in lighter soils.

Duplex soils with a sandy shallow topsoil over a heavier B horizon can be particularly challenging. Low binding and high availability may apply in the A horizon, but strong binding and therefore persistence of the herbicide may occur in the B horizon. This can lead to high levels of exposure to the crop early, with long lived persistence for some products.
Herbicide properties affecting soil binding and availability

Solubility

Solubility is a measure of how much herbicide can dissolve in water, an important consideration with regard to incorporation by rainfall or irrigation and uptake by the germinating weeds. Solubility is usually quoted in mg/L of water at 20°C.

Herbicides with low water solubility often require larger volumes of rainfall to achieve incorporation and tend to be less available in the soil moisture than more soluble products.

Typically, for optimum performance, herbicides with low solubility need good moisture conditions after application and also for the period of desired weed control.

Conversely, herbicides with high solubility are relatively easy to incorporate with limited rainfall. They generally prefer to remain in the soil moisture phase and hence are more freely available to the plant or weed. However, if the herbicide is highly soluble it will have a tendency to move with the soil moisture, and be more likely to leach or cause off target effects.

Binding

When a herbicide is incorporated into the soil, a percentage will bind to the soil organic carbon and soil particles.

The strength of binding is expressed as the Soil/Water Adsorption Coefficient (Kd). The Kd value is the ratio of herbicide adsorbed onto the soil in comparison to the amount remaining in the soil water. It is calculated as follows:

$$Kd = (\text{kg herbicide/kg soil}) / (\text{kg herbicide/L water})$$

As the binding is highly influenced by the level of organic matter, the binding coefficient is often normalised to take into account organic carbon levels in different soils and is presented as a Koc value. The Koc value is calculated by the equation:

$$Koc = Kd / \text{soil organic carbon}$$

The higher the Koc value, the more tightly the herbicide is bound. Herbicides with a low Koc are less tightly bound to the soil and more freely available in the soil water. As a result, they have greater capacity to move with the soil water, especially in sandy soil or soils with low organic matter.

For some molecules the Koc is very sensitive to soil pH, in particular the imidazolinone herbicides which bind tighter at acidic (low) pH.

As soil factors may have a significant bearing on the level of binding, Koc will sometimes be reported as a range (usually with an average across trials), especially where the range is broad.

To understand how this affects interaction in the soil, compare the solubility (Table 2) and average Koc values (Table 3) for the commonly used Group C herbicides atrazine and diuron. Both atrazine and diuron have similar (and low) solubility. However the adsorption coefficient for diuron is significantly higher, indicating that it will bind much tighter to the soil and organic matter at the soil surface, and hence it is effective on many small seeded surface germinating weeds.

Conversely, atrazine is more loosely bound to the soil and will move further down the profile with the wetting front after a rainfall event. Therefore, what is often observed is that atrazine can provide reasonable levels of control of surface germinating weeds if there is just enough rainfall to incorporate the herbicide but not too much to move it deeper in the profile. With additional rainfall the atrazine will move further down the soil profile, often into a 5 to 10cm zone where many larger seeded broadleaf weeds germinate. Atrazine frequently performs better against these larger seeded / deeper germinating targets than diuron, which is more tightly bound to the top 0 to 2cm zone.

Soil moisture

Free soil moisture is critical to the performance of most pre-emergent herbicides. With low available soil water, pre-emergent herbicides that rely on root uptake will be less available.

Once in the soil, the herbicide will establish equilibrium between the amount available in the soil water and that binding onto soil colloids. It typically takes several days for this equilibrium to establish, after incorporation. Most new herbicide labels will generally have a constraint to the effect of ‘Do not irrigate’ or ‘Do not apply if runoff rainfall is expected’ within 2 or 3 days after application. This is partially to allow time for soil binding to take place and the equilibrium to be established.

If available soil water is low, then a greater percentage of herbicide will be bound onto the soil colloids and unavailable for plant uptake. This is why many pre-emergent herbicides may fail to provide good weed control under dry conditions.

A worst case scenario for pre-emergent herbicide efficacy is depicted below. The solution is generally to apply the preemergent herbicide before a rain front, rather than immediately after one.

Figure 3: Dry topsoil with inadequate soil water to allow herbicide uptake by emerging weeds – the perfect storm for

Breakdown

Once in the soil, herbicide breakdown typically occurs via microbial degradation or hydrolysis.

For many herbicides, microbial degradation is the primary path of degradation. Conditions which encourage soil microbes (warm soils, good soil moisture, adequate oxygen and nutrients, neutral pH) will typically see faster degradation and shorter persistence of the herbicide. Extended dry periods which do not support the establishment of microbial populations can substantially increase the persistence of these herbicides.

Soil pH generally does not have a large impact on the persistence of herbicides where the primary breakdown pathway is via microbial degradation. However a key exception is the imidazolinones where the strength of binding is strongly influenced by soil pH. The bioavailability of imidazolinones is increased in higher pH (alkaline) soils and this higher availability in solution also makes imidazolinone herbicides more available for microbial degradation. In low pH (acidic) soils, binding increases thus reducing bioavailability to plants and weeds and also microbes required for breakdown, resulting in increased persistence.

For herbicides that breakdown via hydrolysis reactions, the speed of breakdown is influenced by temperature, moisture and is often highly influenced by pH. The Group C sub-group of triazines and the Group B sub-group of sulfonylureas typically undergo chemical hydrolysis as the primary method of breakdown in neutral or acid soils. However the speed of this reaction decreases (or ceases) as pH increases. Under high pH (alkaline conditions), breakdown then occurs via slower microbial degradation, so hence they persist much longer in alkaline soils.

As a herbicide is broken down, the equilibrium between the herbicide in the soil and the water phase will remain in the same ratio. Typically this means that some of the herbicide bound to the soil particles will be gradually released back into the soil water (desorption) as the herbicide in the water phase is either broken down, lost to leaching or taken up by plants.

Persistence

How long a herbicide remains in the soil depends upon the soil type (binding), temperature, water, organic matter, speed and type of breakdown and application rate.

The rate of herbicide persistence is usually reported as a DT50 value. The DT50 value is a half-life, or the days of time that it takes for 50% of the herbicide in the soil to breakdown.

The rate of breakdown varies between different soils and environmental conditions, so the DT50 is often reported as a range of values, or an average, or both.

In the example following (Figure 4), a moderately persistent theoretical Herbicide A (blue line) has a DT50 value of 60 days.

As can be seen from the graph, if 100 units are applied then after 60 days, 50 units will be remaining. After a further 60 days, 25 units remain. If it takes 80 units of the herbicide to effectively control the target weed (orange line) it can be seen from the graph that Herbicide A will provide approximately 20 days of residual control before there is insufficient herbicide remaining to provide ongoing control.

Figure 4: Persistence over time of a moderately persistent herbicide (DT50 = 60 days).

Molecules with a DT50 under 30 are often classified in herbicide literature as 'non-persistent' as they tend to breakdown relatively quickly. However, these herbicides classified as 'non-persistent' (DT50 less than 30) can still be useful pre-emergent herbicides if applied at a high enough rate to allow them to provide the desired length of residual control.

The graph below includes an example of theoretical Herbicide B - a 'non-persistent' herbicide which has a DT50 of 15 days. Should Herbicide B also require 80 units to control the weed, then it is also possible to obtain the same length of effective residual control by applying a higher starting dose (green line). A number of pre-emergent herbicides used in the Australian grains industry achieve their stated level of residual control by utilising this concept of high application rates to counter the rapid breakdown.

Figure 5: Comparison of a short (DT50 = 15 days) and a moderately persistent herbicide (DT50 = 60 days) over time.

Rotational crop constraints (plantbacks)

By definition, all pre-emergent herbicides, even those classified as non-persistent, usually have some level of plantback constraint to susceptible species.

Products that rely on microbial breakdown for degradation

require an environment where soil organisms are active for prolonged periods of time. As a biological process, it takes time with adequate soil moisture and temperature for a microbial population to build – a process that is unlikely to occur under hot, dry soil conditions. Often, the amount of total rainfall is less important to microbial breakdown than how long the topsoil, which contains most of the microbes and herbicide, is moist for.

NSW DPI publications Weed Control in Summer Crops (Flemming, McNee, Cook, & Manning, 2012) and Weed Control in Winter Crops (Brooke & McMaster, 2014) provide detailed tables of plantback periods for most pre-emergent herbicides used in grains production in Australia. These tables are relevant to NSW soils and may be different for some products in different states.

ALWAYS check and follow the rotational crop advice on the product label.

Using the example shown in Figure 5, where the use patterns of Herbicide A and Herbicide B were both established to provide a similar length of residual control of the target weed (~20 days), the safe plantback period to a susceptible rotation crop can vary significantly.

In Figure 6, theoretical rotational crop A can tolerate 100 units of either herbicide (dark blue line). Therefore, as this rate is the starting application rate of Herbicide

A, there is effectively no plantback limitation for this crop at this application rate, despite the Herbicide A being a moderately persistent product. However, in this example it can be seen that there would be a short, 2 to 3 week plantback to Herbicide B, due to the higher initial application rate, despite Herbicide B being the less persistent product.

Figure 6: Hypothetical comparison of a short (DT50 = 15 days) and a moderately persistent herbicide (DT50 = 60 days) over time relative to a sensitive rotational crop.

However, for these same two theoretical herbicides used in the figures above, a different outcome may be observed if the rotational crop is highly sensitive. In the Figure 7, sensitive rotational crop B (yellow line) can only tolerate 15 units of either herbicide. This example would indicate that rotational crop B could only be sown approximately 60 days after application of the relatively non-persistent Herbicide B.

Table 4: Examples of average DT50 values for selected pre-emergent herbicides.

Herbicide Average Koc value^
dimethenamid-P (Outlook®) 7 (2-16)
prosulfocarb (Boxer® Goldp) 10 (7-13)
metribuzin (Sencor®) 14-28
triasulfuron (Logran®) 19 (3-48)
s-metolachlor (Dual®) 21 (11-31)
pyroxasulfone (Sakura®) 22 (16-26)
terbuthylazine (Terbyne®) 22 (10-36)
chlorsulfuron (Glean®) 36 (11-70)
clopyralid (Lontrel®) 40 (12-70)#
tri-allate (Avadex®) 46 (8-205)
atrazine (Gesaprim®) 60@1 (6-108)
diuron (various) 89 (20-231)
simazine (Gesatop®) 90
pendimethalin (Stomp®) 90 (27-186)
picloram (Tordon®) 90 (20-300)
trifluarlin (Treflan®) 170 (35-375)
diflufenican (Brodal) 180
imazapic (Flame®) 232 (31-410)

^ (University of Hertfordshire, 2006-2014) The Pesticide Properties DataBase (PPDB) developed by the Agriculture & Environment Research Unit (AERU), University of Hertfordshire. Accessed on 4th August 2014
http://sitem.herts.ac.uk/aeru/iupac/index.htm
(Senseman, 2007) Herbicide Handbook (2007) Weed Society of America
@1 (USDA Natural Resources Conservation Service) Windows Pesticide Screening Tool
p DT50 of prosulfocarb. Boxer Gold also contains s-metolachlor

DT50 0 to 30
Non-persistent
DT50 30 to 100
Moderate
DT50 >100
Persistent
Unlikely to have plantback constraints
the following year.
Likely to move with soil water.
Plantback constraints will occur.
Long re-cropping intervals will exist to sensitive crops.

SOIL BEHAVIOUR OF PRE-EMERGENT HERBICIDES IN AUSTRALIAN FARMING SYSTEMS

However, if the sensitive rotational crop B is to be grown after application of Herbicide A, then a plantback of approximately 170 days would be required, in this example.

Figure 7: Comparison of a short (DT50 = 15 days) and amoderately persistent herbicide (DT50 = 60 days) over time relative to a sensitive rotational crop.

Note: These hypothetical examples demonstrate the principle of how application rate, speed of herbicide breakdown and crop/weed sensitivity affects the length of observable symptoms. In practice, different soil types and environmental conditions will vary the speed of breakdown for any herbicide. It is also probable that different species will have different tolerances to each herbicide, unlike the simplified example above.

Any additional stress on germinating weeds or rotational crops will also affect the tolerance of the species to remaining levels of herbicide residue in the soil.

Herbicide manufacturers undertake extensive testing of rotational crops under a range of different environmental conditions and soil types when developing rotational crop recommendations. Always follow the advice on product labels and other supplementary information provided by the manufacturer.

Product labels are designed to cater for typical situations and hence should be followed. However they may not cover all situations and extremes. In borderline situations, the following strategies may provide additional data on which to assess or reduce risk:

- Soil testing may be possible from a laboratory specialising in herbicide residue testing. However this can be time consuming, expensive, and testing may not be available for all molecules. Additionally, test results will only reveal the quantity of herbicide remaining in the soil. If levels of herbicide are detected then this will require interpretation to understand if this level will prevent establishment or healthy growth of the desired crop. Data to help interpret test results is often hard to find.
- A simple bioassay can be conducted whereby seeds of the desired crop are sown into the field a few weeks prior to the desired sowing date and establishment is observed to understand the level of crop injury. This can give a quick indication as to likelihood of any

residues affecting emergence; however care must be taken, especially with herbicides that are more mobile and may have moved down the soil profile. In this situation, germination may be unaffected; however severe damage or plant death could still result when the roots of the new crop extend into the residual herbicide layer further down the profile. Also, some herbicides at sub lethal doses may not greatly affect emergence, but may significantly reduce biomass after emergence. As such, emergence tests can provide false confidence.

■ For herbicides that are tightly bound to the soil surface, aggressive cultivation prior to sowing of a sensitive crop is recommended on the label of some herbicides and may dilute the remaining herbicide throughout the soil profile, resulting in allow improved crop establishment –however this is a risky process to rely on.

■ Switch to a crop variety or crop type that is tolerant to the expected herbicide residue.

■ Avoid applications at sowing or early post-emergent from the same herbicide mode of action group that was used in the preceding crop or fallow, as this may ‘top up’ soil residues.

■ Use good agronomy to promote early crop health and vigour and avoid using any practice that might add an additional plant stress to the crop.

CROP SAFETY

The safety of grain crops sown pre or post application when using a pre-emergent herbicide is an important consideration.

There are a number of strategies that can help promote acceptable crop tolerance. These include:

Crop tolerance. Some crops are inherently more tolerant to a particular herbicide. Usually this tolerance comes from the crop being able to rapidly detoxify that herbicide. There may also be differences between individual varieties in their ability to detoxify a particular herbicide.

An example is the use of chlorsulfuron in wheat. Wheat can quickly detoxify chlorsulfuron via metabolic processes, however if the crop is not metabolising as it is waterlogged or subject to frost, severe crop symptoms can appear as the crop is unable to detoxify the herbicide fast enough.

In some situations a herbicide safener may be able to be used to further accelerate the crops ability to metabolise the herbicide. A good example of this is the application of Concep® II to sorghum seed to accelerate the metabolism of s-metolachlor.

Some crop varieties have been bred to include tolerance to specific herbicides. An example is Clearfield® varieties which express tolerance to imidazolinone herbicides. This enables the use of the particular herbicide mode of action within those crops than would otherwise be lethal, and also provides rotational options in the event of a previous herbicide residue remaining in the soil at sowing.

Differential placement.

If the herbicide has properties that cause it to bind to the soil surface then it may be able to be used in a situation where the crop is sown at a depth below the herbicide band with the roots of the emerging crop growing in soil below the herbicide band. While this may be an effective strategy for some herbicides, crop injury may still occur in situations where herbicide is moved down into or below the crop seed zone, particularly if heavy rainfall occurs as the first incorporating rainfall. Crop damage is often a function of one or more of the following: shallow seeding depth, herbicide placement in (or non-removal from) the crop row, heavy rain after sowing, soil with low binding characteristics and/or products with high solubility and/or low binding.

Physical removal of herbicide in the furrow.

The incorporation by sowing (IBS) technique used in conjunction with knife point seeders can achieve adequate selectivity for some product/crop combinations by physically removing the treated soil directly above the furrow and throwing this into the inter-row - leaving an untreated area through which the crop can emerge. Pay careful attention to seeder set up to ensure that treated soil is not thrown into adjoining crop rows. Press wheels generally help to minimise treated soil from falling back into the furrow. Heavy rainfall after application can still cause problems if treated soil is washed into the furrow.

Regardless of the strategy employed, there may be times when an adverse crop effect still occurs when crop placement and environmental conditions allow some herbicide / crop contact. Frequently situations of crop damage coincide with the emerging crop seedling being under additional stress that slows the rate of metabolism, reducing the crop’s ability to detoxify the herbicide. This is often observed in situations of waterlogging or prolonged cold or frost.

Pay careful attention to seeder set up to ensure that treated soil is not thrown into adjoining crop rows.

CROP SAFETY
Waterlogging in combination with pre-emergent herbicides may sometimes cause crop injury.
PHOTO: Mark Congreve

To understand how a pre-emergent herbicide will behave in the farming system, agronomists should understand:

SELECTIVITE

Eviter les problèmes de phytotoxicité.

Bien connaître les spécificités du produit utilisé.

Quel est le moyen le plus sûr pour utiliser des herbicides de preé-émergence au semis?
Posted in Ask an Expert on April 14, 2016

Lien : http://weedsmart.org.au/whats-the-safest-way-to-manage-pre-em-herbicides-at-seeding/

L'obtention d'un contrôle efficace des mauvaises herbes en période prélevée tout en protégeant la sécurité des cultures lors de l'ensemencement n'est pas un atout, avec beaucoup de variables à gérer.

Le Dr Sam Kleemann, chercheur associé à l'Université d'Adelaide, a étudié les systèmes de semis et les combinaisons d'herbicides pré-émergents qui donnent les meilleurs résultats dans des circonstances différentes.

Une gamme d'herbicides très diversifiée

«Le contrôle précoce des mauvaises herbes est plus important que jamais, et les herbicides en prélevée ont un rôle important à jouer, ce qui permet souvent de lutter contre les mauvaises herbes à plusieurs générations pendant que la culture s'établit», dit-il. «La difficulté réside dans le fait que ces produits herbicides varient considérablement en ce qui concerne leur solubilité et leur tendance à se lier à la matière organique, ce qui peut entraîner une variabilité considérable de l'efficacité de la lutte contre les mauvaises herbes et de la sécurité des cultures.

Le Dr Kleemann dit que la compréhension de la manière dont les différents produits se comportent influencera les décisions des producteurs et des conseillers lors de la sélection des produits et de la mise en place de leur équipement pour l'ensemencement.
Le Dr Sam Kleemann indique que la mise en place du semoir et le choix du produit sont des décisions cruciales lors de l'utilisation d'herbicides pré-émergents pour lutter contre les mauvaises herbes au début du cycle végétal.

Le Dr Sam Kleemann indique que la mise en place du semoir et le choix du produit sont des décisions cruciales lors de l'utilisation d'herbicides pré-émergents pour lutter contre les mauvaises herbes au début du cycle végétal.

Minimiser les perturbations du sol

«Il y a quelques règles empiriques qui peuvent aider au semis», dit-il.
«**Le premier** est de minimiser les perturbations du sol afin que les graines de mauvaises herbes restent sur la surface du sol autant que possible.

"**La seconde** est de se rappeler que les herbicides pré-émergents peuvent causer des dommages aux cultures. Il est essentiel de séparer le produit des semences de la culture. "

"**La troisième règle** est de choisir le bon herbicide pour le travail et de suivre les recommandations label étroitement."

Il existe de nombreuses différences dans les propriétés des produits pré-émergents tels que leur volatilité et leur taux de dégradation dans la lumière du soleil.

Les systèmes de semis comportants des dents permettent généralement une meilleure sécurité des récoltes lorsqu'on utilise un herbicide en prélevée que les disques de faible perturbation. Les disques triples sont plus sûrs que les semoirs monocylindriques, à condition que le jet de terre soit adéquat.

Pourquoi minimiser les perturbations du sol lors de l'ensemencement est-elle si importante?

Réponse courte: Les graines de mauvaises herbes sur ou très près de la surface du sol ont le plus d'exposition à la bande concentrée d'herbicide.

Réponse plus longue: Si les graines de mauvaises herbes sont enterrées et mélangées dans le sol, elles ont une plus grande chance d'éviter l'herbicide que lorsqu'elles sont concentrées sur ou à proximité de la surface. Si une graine de mauvaises herbes germe et établit un système racinaire avant d'intercepter l'herbicide en prélevée, la mauvaise herbe est souvent capable de croître à travers la couche d'herbicide. Bien qu'elle puisse être supprimée, elle ne mourra probablement pas.

Quelle est la meilleure façon de garder l'herbicide loin de la graine de la culture?

Réponse courte: Suivez attentivement les instructions de l'étiquette. Les herbicides pré-émergents sont principalement non sélectifs et causeront des dommages aux cultures s'ils sont projetés avec de la terre ou lessivés dans le sillon.

Réponse plus longue: Les systèmes de semis qui rejettent la terre loin du sillon fournissent la plus grande protection pour la culture.
Les semoirs à dents fournissent généralement une incorporation des herbicides suffisante tout en maintenant une séparation de la graine de culture. Éviter de projeter trop de terre d'un sillon à l'autre.

Les herbicides pré-émergents ne sont pas recommandés pour les semoirs à disques à faible perturbation du sol en raison du manque de fiabilité de la séparation entre herbicides et graines de culture et du risque accru de dommages aux cultures.

Z O O M

Les herbicides pré-émergents ne sont pas recommandés pour les semoirs à disques du fait de leur faible perturbation du sol en raison du manque de fiabilité concernant la séparation des herbicides des semences de la culture d'où un risque de dommages aux cultures.

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Pourquoi les instructions des étiquettes pour les produits herbicides en prélevée varient-elles tellement?

Réponse courte: Chaque produit a des propriétés différentes qui ont un impact sur l'efficacité et la sécurité des cultures.

Réponse plus longue: Les propriétés telles que la solubilité, le besoin d'incorporation, la liaison à la matière organique, le taux de dégradation dans l'environnement et ainsi de suite font une grande différence dans la façon dont un herbicide est utilisé.

CONSEILS

Utilisez ces informations pour prendre des décisions de choix de produits qui tiennent compte de la charge de chaume, des prévisions de précipitations à courte terme, de la date de semis et du matériel d'ensemencement et de la mise en place.

MODE D'ACTION

Quel mode d'action?

Le mode d'action du produit dicte les conditions d'application.

Le mode d'action du produit dicte les conditions d'application

Lise GAUTELLIER VIZIOZ (ARVALIS - Institut du végétal)

20 mars 2014

L'efficacité des produits de contact est très sensible à la qualité de la pulvérisation, tandis que celle des herbicides à action racinaire est plus dépendante de la présence d'eau ou d'argile dans le sol. Enfin, l'utilisation de produits systémiques doit se faire préférentiellement lorsque l'humidité de l'air est élevée et les températures clémentes.

Dans une dynamique de raisonnement des doses et de sécurisation des efficacités de désherbage et de protection de l'environnement, les conditions et les techniques d'applications constituent deux leviers incontournables.

En effet si le leitmotiv bien connu, « le bon produit à la bonne dose », reste toujours d'actualité, la prise en compte du stade d'application, des conditions agrométéorologiques (température, hygrométrie), mais également de la qualité de pulvérisation (volume/ha, choix des buses, pression) est déterminante pour prendre les bonnes décisions d'intervention et réussir son traitement. ARVALIS - Institut du Végétal rappelle les règles des conditions d'application en fonction des produits utilisés.

L'efficacité des produits systémiques dépend des conditions climatiques et de l'humidité du sol

Les herbicides systémiques, une fois sur la feuille, pénètrent et migrent dans la plante. Ainsi, avec ce type de produit, il faut chercher les conditions favorables à une pénétration rapide et massive à travers la cuticule des plantes : forte hygrométrie (> 60-70 %), températures clémentes (5 à 25°C), mais aussi sol humide. En effet des études ont montré que pour une partie des herbicides systémiques (les inhibiteurs de l'ALS par exemple), une partie du produit pouvait être absorbé par le système racinaire. Il est donc préférable d'appliquer les sulfonylurées en conditions de sol frais (humide) plutôt que sec, le tout avec des bonnes températures et hygrométrie. Certains produits à pénétration strictement foliaire ne seront pas affecté par l'humidité du sol (les produits auxiniques ou de la famille des inhibiteurs de l'ACCase). Ce constat incite à appliquer les anti-graminées très tôt en sortie d'hiver afin de gagner en efficacité.

Par ailleurs, cette mobilité dans la plante confère à ces matières actives une plus grande indépendance vis-à-vis de la qualité de pulvérisation. Ainsi, il est possible d'utiliser des buses peu sensibles à la dérive (injection d'air) et de réduire le volume de bouillie sans affecter l'efficacité des traitements. En effet, dans tous les essais menés, aucune baisse d'efficacité significative imputable à l'utilisation de buses à injection d'air n'a été constatée pour des volumes allant jusqu'à 50 l/ha. Attention cependant, tous les essais ont été réalisés dans des conditions climatiques très favorables. Dans des conditions plus risquées, il ne faut pas hésiter à remonter les volumes, et aussi les doses.

Parmi les produits systémiques, il est possible de citer les « sulfonylurées » mais également les « Fop/ Dimes/ Den » ou anti-graminées foliaires.

Produits de contact : la qualité de pulvérisation est primordiale

Les produits de contact sont très peu mobiles dans les plantes. Ils agissent « là ou ils tombent ». De ce fait, plus la cible est couverte, meilleure est l'efficacité du traitement. Avec ce type de produit, la qualité de pulvérisation est un facteur qui influe beaucoup sur l'efficacité finale du traitement. Une pulvérisation grossière (grosses gouttes) à un volume/ha trop faible peut affecter considérablement l'efficacité du traitement. Ces phénomènes ont été observés par exemple pour le désherbage du maïs avec EMBLEM, où les traitements à bas volume (50 l/ha) avec des tailles de gouttes importantes (buse à injection d'air) affectent très significativement l'efficacité des applications.

CONSEILS

Ainsi, avec les produits de contact, il ne faut donc pas cumuler les risques. L'utilisation de buses à injection d'air est possible à condition qu'elle ne soit pas accompagnée d'une application à des volumes trop faibles (inférieurs à 80 l/ha) et/ou en situation de réduction de dose.

Z O O M

Ces phénomènes sont encore plus marqués dans les situations où la taille des mauvaises herbes est réduite.

VOLUME DE BOUILLIE

Quel volume de bouillie utiliser?

Le volume de bouillie ne joue pas sur l'efficacité des herbicides racinaires.

Herbicides à mode d'action racinaire : tenir compte de la teneur en eau et en argile

L'efficacité des herbicides qui agissent au niveau des racines ou qui y pénètrent, n'est pas dépendante de la qualité de pulvérisation. En effet, une fois à terre, les substances actives migrent dans l'eau du sol pour rejoindre les racines des plantes cibles. En revanche, il est nécessaire de pulvériser ces produits sur un sol frais (humide) qui permettra la circulation du produit jusqu'aux racines et permettra de garantir l'efficacité du traitement. L'efficacité des produits racinaires est également dépendante des quantités d'argile et de matière organique présentes dans le sol. Plus la teneur en argile et/ou en matière organique est élevée, plus les molécules d'herbicides sont retenues par le sol. Les substances actives ne sont alors plus disponibles pour agir contre les adventices.

Finalement, la seule contrainte lors de l'application de ces produits racinaires est la lutte contre la dérive. L'utilisation de buses à injection d'air n'affectant pas l'efficacité est donc vivement recommandée.

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Traitement phytosanitaire
Le volume de bouillie ne joue pas sur l'efficacité des herbicides racinaires
Arvalis.fr 31 octobre 2012

L'efficacité des herbicides racinaires dépend avant tout de la quantité d'eau présente dans le sol. Le type de buse utilisé et le volume de bouillie n'ont aucune incidence. En revanche, la teneur en argile et en matière organique sont également à prendre en compte.

ZOOM

Les produits racinaires ne sont pas sensibles à la qualité de pulvérisation. C'est bien l'eau présente dans le sol qui permet de les transporter jusqu'aux racines ou graines en germination (rappel = 1 mm de pluie = 10000 l/ha). Ainsi, ils peuvent être pulvérisés à n'importe quel volume de bouillie. Les traitements en bas volumes sont donc envisageables pour les herbicides à mode d'action racinaire. Ils sont également indifférents au type de buse utilisée (fente classique ou injection d'air).

Dans le cas d'un sol trop sec au moment de l'intervention, il convient alors de privilégier des produits à action foliaire (contact ou systémique). Passer de 100 l/ha par exemple à 200 l/ha n'augmente pas l'efficacité du produit. La teneur en argile et en matière organique sont également à prendre en compte. L'isoproturon est par exemple un produit dont la dose s'adapte en fonction du type de sol.

CONSEILS

Même si les conditions climatiques ne jouent pas sur l'efficacité des produits racinaires, il est incontestable que pulvériser par forte hygrométrie réduit la part d'évaporation des gouttelettes et optimise le dépôt de produit sur le sol.