Terbuthylazine

Key Points

- Terbuthylazine (e.g. Gardoprim®) is a selective residual triazine herbicide registered for pre and/or post emergent weed control for crops including lucerne, maize, sorghum and peas.
- Use of the herbicide in Wheat and Barley is undertaken on an off-label basis.
- Growers using this active ingredient in 2006 encountered more crop damage than has been previously noted. At some sites this will be due to cool soil temperatures increasing the residual life of the herbicide.
- FAR trial observations in 2006 illustrated that sowing depth and final sowing depth after consolidation greatly influenced the level of crop damage recorded with terbuthylazine.
- This Arable Extra has been produced as a result of requests for more information on how this herbicide works: its mode of action and its behaviour in the soil.

Introduction

Terbuthylazine (e.g. Gardoprim®) is a selective residual herbicide for grass and broadleaf weed control in forestry, maize, sweet corn, peas, certain orchard crops, and long-term non-selective weed control in non-crop situations. Terbuthylazine belongs to the s-Triazine chemical family which includes a large number of herbicides widely used in agriculture practice for pre-emergence and post-emergence weed control.

Its cost and broad spectrum activity has lead to this herbicide having a wide range of applications in New Zealand’s arable cropping scene. This use has been both on-label, and off-label such as cereals.

The autumn/winter period last season resulted in a number of terbuthylazine applications causing damage, in particular off-label in cereals. As a result a number of FAR Arable Research Groups (ARG’s) requested more information on this herbicide, in terms of mode of action, and the conditions that lead to crop damage. This Arable Extra has been produced from a wide range of sources but also includes some important trial results from last season on the interaction between planting depth and resultant crop damage.

Trade Names:
AGPRO TERBUTHYL AZINE 500
ASSETTM
GARDOPRIM® 500 FW
TERBAFLO
TYLLANESTM

Active Ingredients:
AGPRO Terbuthylazine 500, Assett, Gardoprim 500FW, Terbaflo and Tyllanex contain 500 g/l terbuthylazine in the form of a suspension concentrate. Assett and Tyllanex also contain 35 g/l and 50 g/l of ethylene glycol respectively.

Mode of Action

Terbuthylazine herbicides are taken up by the roots of weed seedlings and to some extent by the emerging cotyledons. Due to their low aqueous solubility, triazines do not appreciably penetrate to lower levels of the soil and consequently they have little effect on deep rooted crops or weeds.

Triazine herbicides influence plant growth by:
- Inhibition of photosynthetic pathways;
- Blockage of carbon fixation, in essence starving the plant tissue;
- Oxidation of chlorophyll and membrane lipids; resulting in the bleached appearance of treated leaf tissue (Chlorosis → Necrosis).

At recommended rates, the triazine herbicides have been shown to inhibit the growth of all organs of intact plants. However, at sub toxic concentrations certain triazine herbicides have been shown to stimulate growth.

The rate of degradation of triazine herbicides in higher plants varies greatly with different species. In particular maize and sorghum are resistant to triazine herbicides. The common cause of resistance is the metabolic inactivation of herbicide. This is the basis for their selective use in several crops, as well as the fact that a few species are not controlled.

Application

Terbuthylazine controls a wide range of annual and perennial grass and broadleaf weeds including barley grass, black nightshade, browntop, catsear, chickweed, clovers, cocksfoot, dove’s foot, fat hen, Kentucky blue grass, lotus, Poa spp, redroot, ryegrass, seedling gorse, shepherd’s purse, storksbill, sweet vernal, thistles, willow weed and Yorkshire fog. See the product label or refer to the NZ Agrichemical Manual or NovaChem manual.
Activity on key weed and crop grass species at different rates has been the subject of FAR herbicide screening work over the last 4 seasons (Arable Extra No’s: 40, 47, 60 and 67). This work has identified the herbicide having a useful role for brome control as a pre-emergence application.

Naturally occurring weed biotypes resistant to triazine herbicides can become more prevalent after many years of continuous use. To delay the onset of resistance or control of resistant weeds, it is advisable to use terbuthylazine in rotation with herbicides of different mode of action.

2006 Crop Damage in relation to sowing depth
Trials conducted by FAR into the interaction between terbuthylazine and depth of planting for wheat found reduced establishment due to herbicide damage in shallow sown treatments. The impact of pre-emergent application of terbuthylazine on shallow (1cm depth) and deep (4cm depth) planted wheat is shown in Table 1.

Table 1. Impact of terbuthylazine applied pre-em (9th June 2006) on wheat cv Torlesse sown 8th June - assessed 31st August

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Depth (Sown)</th>
<th>Pre-emergent Herbicide</th>
<th>%Biomass Damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1cm-Shallow</td>
<td>Untreated</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>1cm-Shallow</td>
<td>Gardoprim 1.5 l/ha</td>
<td>63</td>
</tr>
<tr>
<td>3</td>
<td>4cm-Deep</td>
<td>Untreated</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>4cm-Deep</td>
<td>Gardoprim 1.5 l/ha</td>
<td>6</td>
</tr>
</tbody>
</table>

Sowing and application were conducted one week prior to the heavy snow and heavy rain fall on June 12th. Weed control given by terbuthylazine in herbicide trials were generally good last season, however this trial illustrates the importance of seed depth protection if used off-label on cereals.

Environment and Cultural
One of the original chemicals introduced in the Triazine group, Atrazine, was banned by European regulators due to its persistence in the environment and contamination of water resources. Subsequently, terbuthylazine was introduced as an atrazine substitute. Despite lower water solubility and lower persistence in soil the current approval for use of terbuthylazine in the United Kingdom expires Dec 2007 due to similar environmental concerns of persistence and contamination.

Terbuthylazine has been found to have a half life in biologically active soils of 30-60 days. Terbuthylazine is readily absorbed by soils which may protect the molecule from microbial breakdown and hence extend the half life. The movement of terbuthylazine from field crops to bodies of water is greatly influenced by rainfall timing, intensity and duration, rate of chemical application, and soil texture and condition. Rain or irrigation of at least 10mm within 1 week is necessary to wash the applied chemical into the root zone. Pre-emergent applications may be made when rain is imminent or actually falling (provided it is expected not to be excessive), but post emergent applications should be avoided if rain is likely with 3 hrs after application.

The rate of degradation of terbuthylazine in soil has been found to be influenced by temperature. Residual life of the chemical has been found to increase in low temperatures and one such study shows residual life could be as much as 5 times longer when two temperature (10°C & 30°C) were compared.

As terbuthylazine is applied to the soil surface, the fate of the chemical in soil depends on the interaction between its molecules and soil components. In mineral soils, two major types of adsorbing surfaces are normally available to herbicides: soil organic matter and clay. In general, soils high in organic matter and/or clay content are considered to have a greater adsorptive capacity for the chemical. Correspondingly, soils of a sandy or stony nature will have a reduced absorptive capacity.

As noted, terbuthylazine has a low aqueous solubility and does not appreciably penetrate below 5-10cm of the soil profile (again dependent soil texture and organic matter content). Obviously where soils are stoney with low organic matter herbicide movement could be expected to be greater following heavy rainfall. Again this illustrates the value of seed depth protection (Table 1). Soil moisture content was found to have less of an impact on terbuthylazine degradation rates. Studies indicate the degradation of atrazine was found to be insensitive to pH changes, this is thought similar for terbuthylazine.

Although the practice of post sowing rolling of paddocks is considered to have minimal impact on herbicide dynamics within the soil profile once, most UK labels referring to the use of this active ingredient consider a moist, firm seedbed a pre-requisite for pre emergence use.

For information on recommended rates, compatibility, application, toxicity, precautions and disposal; see the product label or refer to the NZ Agrichemical Manual (available from leading rural retailers and direct from the publisher (Agri Media Ltd, PO Box 37-151 Christchurch Phone 03-329-6555) or NovaChem Manual.

References

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