The one-pass post-emergent herbicide for control of various grass and broadleaf weeds in wheat
INTRODUCTION

Hussar® is the first post-emergent selective broad-spectrum herbicide for use in wheat in Australia which controls an extensive range of both grass and broadleaf weeds. Hussar contains the active ingredient iodosulfuron-methyl-sodium, a sulfonylurea herbicide belonging to the Group B mode of action herbicide family for resistance management.

Hussar combines iodosulfuron-methyl-sodium with a crop safener, mefenpyr-diethyl, to ensure a high level of selectivity without compromising product effectiveness, setting it apart from other traditional Group B herbicides. Iodosulfuron-methyl-sodium is effective against the grassweed species annual ryegrass, wild oats and annual phalaris, as well as a large range of broadleaved weeds including some difficult-to-control weeds such as wild radish, Indian hedge mustard, wireweed, doublegey (spiny emex), volunteer legumes, fumitory, toadrush, deadnettle, and black bindweed.

Hussar has been in development in Australia since 1993, and over 300 trials have been conducted across the key cereal-growing areas since then, with further product-extension development still occurring.
**BIOLOGICAL PROPERTIES**

**Mode of action**
As with other herbicides of the sulfonylurea family, the primary biochemical target site of iodosulfuron-methyl-sodium is the enzyme acetolactate synthase (ALS). The visible symptoms of herbicidal action are arrested growth within the first few days after application and the appearance of chlorotic patches, followed by slow shoot necrosis. Susceptible plants stop growth almost immediately after post-emergence application. Plants will be completely killed 4 to 6 weeks after application under good growing conditions.

**Effect of placement on herbicidal action**
Special placement studies in the greenhouse showed that iodosulfuron-methyl-sodium acts on the target weeds through both the foliage and the soil, with a predominance of foliar action. After controlled application to a fully developed leaf of wild oat plants, the active ingredient effectively inhibited the development of new leaves at the shoot apex, indicating that the herbicide has phloem-systemic properties.

**Foliar uptake and translocation**
In grass species the foliar uptake of 14C-labelled iodosulfuron-methyl-sodium took place mainly on the day of application, with little further increase. Between 5 and 10% of the amount that was taken up by a fully developed leaf was subsequently translocated to the other parts of the plant. Translocation to the shoot base and the root was usually higher than translocation to the shoot parts above the treated leaf. The uptake and translocation behaviour in wild oats, as a typical grassweed, is in principle similar to that in wheat.

In mustard, as a representative of dicotyledonous species, rates of foliar uptake and translocation were higher than in the grass species.

**Degradation in plants**
The degradation of 14C-labelled iodosulfuron-methyl-sodium in wheat and wild oats was compared. The rate of degradation was significantly more rapid in wheat than in wild oats, which indicates the basis of the selective action of iodosulfuron-methyl-sodium.

**Mode of safener action**
The action of a safener on a crop can be based on one or more of the following effects:
- reduction of herbicide uptake and translocation
- interference at the biochemical site of herbicide action
- enhancement of herbicide degradation in the crop

In a series of experiments, the behaviour of the herbicide iodosulfuron-methyl-sodium, when applied alone, was compared with its behaviour in combination with the safener mefenpyr-diethyl.

The safener did not significantly influence the uptake and translocation of iodosulfuron-methyl-sodium in wheat. Furthermore, in vivo tests of ALS activity did not indicate an antagonistic safener/herbicide interaction at the biochemical herbicide target. When shoots of wheat which had been treated with 14C-labelled iodosulfuron-methyl-sodium and the safener were extracted and analysed, a lower percentage of the extractable 14C was in the form of the parent compound iodosulfuron-methyl-sodium than in extracts from plants which had not received a safener treatment. No significant difference was found when shoots of wild oat were subjected to the same treatments.

These findings suggest that the safener acts by specific enhancement of herbicide degradation in the crop.

**BEHAVIOUR IN THE ENVIRONMENT**

**In crops**
Uptake of the active ingredient occurs mainly via the leaves. About 5–10% of the amount taken up is translocated to the shoot base and the roots.

The metabolism of iodosulfuron-methyl-sodium in wheat was investigated using test substance labelled at two different positions of the molecule. Total extractable radioactive residues in grain at harvest were less than 0.01 ppm (limit of quantitation).

**In soil**

**Sorption kinetics**
Adsorption/desorption was tested in a range of soil types from sand to heavy clay. Equilibrium conditions were achieved after 4 hours for all soils. The substance exhibited a low to moderate tendency to adsorb to soil. Its adsorption/desorption behaviour can be correlated to cation exchange capacity and clay content of the soil.

**Soil degradation**
In the laboratory, the active substance and its major metabolite are degraded in active soils under standard conditions (20°C, humidity 40% of water retention capacity) with an average halflife of approximately 43 ± 23 days (mean of 10 values).

Under field conditions, the active substance is degraded with halflives of 9.7 ± 4.8 days (mean of 18 trials in 6 locations). For the major metabolite metsulfuron-methyl, DT<sub>50</sub> values of 21 ± 18 days were determined in the same trials.

**In water**

Degradation of iodosulfuron-methyl-sodium in two water/sediment systems indicated that degradation was relatively rapid in both water (DT<sub>50</sub>s of 12 and 19 days, DT<sub>90</sub>s of 42 and 64 days) and the whole system (DT<sub>50</sub>s of 1.3 and 25 days and DT<sub>90</sub>s of 43 and about 81 days).

Consequently, iodosulfuron-methyl-sodium in water/sediment systems is considered to be non- to slightly persistent. Metsulfuron-methyl, again formed by degradation of iodosulfuron-methyl-sodium, was the main metabolite in the water/sediment systems and was classified as having slight to moderate persistence with DT<sub>50</sub>s of 34–55 days and DT<sub>90</sub>s of 114–183 days.

**In animals**
The behaviour and metabolism of iodosulfuron-methyl-sodium in the mammalian organism was investigated in rats and dogs. Test substance labelled at two different positions was administered orally at a high dose (500 mg/kg body weight) and a low dose (10 mg/kg b.w.).

The test substance was rapidly absorbed. Excretion was also rapid and complete, with the majority being excreted during 48 hours after dose administration. The parent compound was the major component excreted (86%), mainly in the urine.
**EFFECTS ON FAUNA AND FLORA**

**Fish**
Acute tests were performed with both a warm and a cold water fish species, and a prolonged study was made of rainbow trout. All studies indicate that the active ingredient is of low toxicity to fish.

<table>
<thead>
<tr>
<th>Species</th>
<th>Study type/duration</th>
<th>LC₅₀ (mg/L)</th>
<th>NOEC (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainbow trout</td>
<td>Static acute (96 h)</td>
<td>&gt;100</td>
<td>100</td>
</tr>
<tr>
<td>Blugil sunfish</td>
<td>Static acute (96 h)</td>
<td>&gt;100</td>
<td>100</td>
</tr>
<tr>
<td>Rainbow trout (Oncorhynchus mykiss)</td>
<td>Flow-through juvenile growth test (28 days)</td>
<td>–</td>
<td>32</td>
</tr>
</tbody>
</table>

**Fish-food organisms** *(invertebrates)*
In acute as well as prolonged studies, iodosulfuron-methyl-sodium proved to be of low toxicity to daphnia.

<table>
<thead>
<tr>
<th>Species</th>
<th>Study type/duration</th>
<th>EC₅₀ (mg/L)</th>
<th>NOEC (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water flea (Daphnia magna)</td>
<td>Static acute (48 h)</td>
<td>100</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Static renewal reproduction test (21 days)</td>
<td>–</td>
<td>10</td>
</tr>
</tbody>
</table>

**Algae**
In growth inhibition tests, algae showed significant species-dependent variations in sensitivity to iodosulfuron-methyl-sodium.

<table>
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<tr>
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<th>EC₅₀ (mg/L)</th>
<th>NOEC (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green alga (Pseudokirchneriella subcapitata)</td>
<td>Growth inhibition static (96 h)</td>
<td>E₅₀ EC₅₀: 0.055  E₅₀ EC₅₀: 0.152</td>
<td>0.018</td>
</tr>
<tr>
<td>Diatom alga (Navicula pelliculosa)</td>
<td>Growth inhibition static (96 h)</td>
<td>E₅₀ EC₅₀: &gt; 100  E₅₀ EC₅₀: &gt; 100</td>
<td>100</td>
</tr>
</tbody>
</table>

**Higher aquatic plants**
Its herbicidal mode of action makes iodosulfuron-methyl-sodium highly toxic to higher aquatic plants.

<table>
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<tr>
<th>Species</th>
<th>Study type/duration</th>
<th>NOEC (µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lemna gibba</td>
<td>Growth inhibition test</td>
<td>0.4</td>
</tr>
<tr>
<td>Elodea canadensis</td>
<td>Growth inhibition test</td>
<td>0.46</td>
</tr>
<tr>
<td>Myriophyllum spicatum</td>
<td>Growth inhibition test</td>
<td>1.0</td>
</tr>
</tbody>
</table>

**Effects on birds**
Acute and dietary tests with two bird species showed that iodosulfuron-methyl-sodium is of very low toxicity to birds.

**Acute oral toxicity**

<table>
<thead>
<tr>
<th>Species</th>
<th>Study type/duration</th>
<th>LD₅₀ (mg/kg b.w)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japanese quail (Coturnix coturnix japonica)</td>
<td>14-day acute oral</td>
<td>&gt;2000</td>
</tr>
<tr>
<td>Mallard duck (Anas platyrhynchos)</td>
<td>14-day acute oral</td>
<td>&gt;2000</td>
</tr>
</tbody>
</table>

**Short-term toxicity**

<table>
<thead>
<tr>
<th>Species</th>
<th>Study type/duration</th>
<th>LD₅₀ (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japanese quail (Coturnix coturnix japonica)</td>
<td>8 day dietary</td>
<td>&gt;2000</td>
</tr>
<tr>
<td>Mallard duck (Anas platyrhynchos)</td>
<td>8 day dietary</td>
<td>&gt;1600</td>
</tr>
</tbody>
</table>

**Effects on bees**
Iodosulfuron-methyl-sodium is of very low toxicity to bees.

<table>
<thead>
<tr>
<th>Species</th>
<th>Study type/duration</th>
<th>LD₅₀/LD₅₀</th>
<th>LD₅₀ (µg a.i./bee)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honey bee (Apis mellifera)</td>
<td>Contact toxicity/24, 48, 72 h</td>
<td>&gt; 150</td>
<td>&gt; 80 µg a.i./bee</td>
</tr>
<tr>
<td>Honey bee (Apis mellifera)</td>
<td>Oral toxicity/24, 48, 72 h</td>
<td>&gt; 150</td>
<td>&gt; 80 µg a.i./bee</td>
</tr>
</tbody>
</table>

**Wild mammals**
Based on the low mammalian toxicity of iodosulfuron-methyl-sodium observed in mammalian oral, dermal and inhalation studies, no adverse effects of the product on wild mammals are to be expected under normal use conditions.

**Bacteria**
Iodosulfuron-methyl-sodium was harmful to a single bacterial strain, but no adverse effects on bacteria in sewage treatment plants were observed.

**Effects on soil micro-organisms**
Under normal use conditions, the substance is not expected to lead to detrimental effects on respiration and nitrogen turnover in soil.
RESISTANCE MANAGEMENT

GROUP B HERBICIDE

Resistant Weeds Warning
Hussar Selective Herbicide is a member of the sulfonylurea group of herbicides and has the inhibitor of ALS mode of action. For weed resistance management, Hussar is a Group B herbicide. Some naturally occurring weed biotypes resistant to Hussar, and other herbicides which inhibit ALS, may exist through normal genetic variability in any weed population. These resistant individuals can eventually dominate the weed population if these herbicides are used repeatedly. These resistant weeds will not be controlled by Hussar or other Group B herbicides.

Since occurrence of resistant weeds is difficult to detect prior to use, Bayer CropScience Pty Ltd accepts no liability for any losses that may result from the failure of Hussar to control resistant weeds.

Specific guidelines for Group B herbicides

Group B (ALS Inhibitors)
1. Use only one application of a Group B herbicide per season.
2. If a Group B herbicide has been applied pre-emergence, DO NOT apply further Group B herbicides to that crop. Make any further post-emergent applications with herbicides from a different mode of action group.
3. Apply no more than two Group B herbicides in any four-year period on the same paddock.
4. If a post-emergent application is made with a Group B herbicide, this should preferably be as a tank-mix with another chemical with a different mode of action that controls or has significant activity against the target weed. If any further applications are required in that season, it should be with a non-ALS mode of action herbicide that controls the target weed.
5. A Group B herbicide may be used alone on flowering wild radish only if a Group B herbicide has not been previously used on that crop.
6. Where Onduty® is to be used, refer to the Clearfield® Production System Canola Best Management Practice guide.

The above recommendations should be incorporated into an Integrated Weed Management (IWM) program. In all cases try to ensure that surviving weeds from any treatment do not set and shed seed. Keep to the integrated strategies mentioned in this brochure, including rotation of mode of action groups. Make sure the products you rotate between are from different mode of action groups.

MARKET POSITIONING

Post-emergent grass herbicide selection for use in wheat

Please consult the table below to determine the preferred herbicide for the various scenarios, which can occur when wild oats emerge in wheat.

To assist with herbicide resistance management, an integrated weed management strategy suggests rotating herbicides from the chemical groups available.

TACTICAL KEY

Early post-em (Z12–24)

<table>
<thead>
<tr>
<th>Preferred herbicide choice</th>
<th>Preferred Group A herbicide</th>
<th>Preferred Group B herbicide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wild oats alone</td>
<td>Wildcat®</td>
<td>Hussar®</td>
</tr>
<tr>
<td>Wild oats with BLWs</td>
<td>clodinafop</td>
<td>Wildcat®</td>
</tr>
<tr>
<td>Wild oats + Annual ryegrass</td>
<td>Tristar® Advance</td>
<td>Tristar® Advance</td>
</tr>
<tr>
<td>Wild oats with BLWs</td>
<td>tralkoxydim</td>
<td>Hussar</td>
</tr>
<tr>
<td>Wild oats + Annual phalaris</td>
<td>Hussar</td>
<td>Atlantis</td>
</tr>
<tr>
<td>Wild oats with BLWs</td>
<td>Atlantis</td>
<td>Hussar</td>
</tr>
<tr>
<td>Wild oats + Annual phalaris</td>
<td>Hussar</td>
<td>NHA</td>
</tr>
<tr>
<td>Wild oats with BLWs</td>
<td>NHA</td>
<td>Hussar</td>
</tr>
<tr>
<td>Wild oats + Brome grass*</td>
<td>Atlantis</td>
<td>NHA</td>
</tr>
<tr>
<td>Wild oats with BLWs</td>
<td>NHA</td>
<td>NHA</td>
</tr>
</tbody>
</table>

Late post-em (Z13–30)

<table>
<thead>
<tr>
<th>Preferred herbicide choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wild oats alone</td>
</tr>
<tr>
<td>Wild oats + BLWs</td>
</tr>
</tbody>
</table>

# – Requires the addition of a broadleaf herbicide (i.e. Tigrex®, Jaguar®, Eclipse®)
NHA – No herbicide option available
BLWs – Broadleaf weeds
† – Hussar and Atlantis control Phalaris paradoxa
* – Suppression of great brome only
1 – Tactical key refers to weed control in wheat only.
**WEED CONTROL**

**General efficacy**

Hussar, as a sulfonylurea herbicide, acts differently to the grass-specific post-emergent herbicides, such as those from the ‘top’ chemistry group (Hoegrass®, Tristar® Advance, Wildcat®), and the ‘dim’ chemistry group herbicide (Achieve®).

The visual herbicide symptoms associated with the use of Hussar are typical of the sulfonylurea herbicides, although the product can appear to be slow-acting in comparison to the more specific grass herbicides.

Initial symptoms of herbicidal activity are a discolouration of the weed with a cessation of growth. The plants may remain in this state until late in the season, when, with the normal dry conditions in spring, the plant will collapse and desiccation of tissue will occur.

This effect makes evaluation of control with this herbicide difficult, since plants may appear to be still alive, but are actually severely affected by the herbicide. Weed growth will be severely reduced and it is necessary to inspect weeds late in the season to accurately determine the final level of control achieved.

Weed control in trials is either assessed by plant counts (counts of weeds that have survived the herbicide application and either continue to grow after spraying or re-shoot after some initial severe herbicidal effect) or by an estimate of the biomass reduction compared to weeds in untreated plots in the trial. For a slow-acting herbicide like Hussar, an estimate of biomass late in the season is a more reliable method of determining weed control. For a claim of control, trial results will reliably show that weed growth or the number of plants remaining at the end of the season will be reduced by at least 90%. Suppression of a weed species is claimed if the level of control is between 80 and 90%. There will be some trials showing a lower level of control, but these can usually be explained by adverse climatic factors.

**DIRECTIONS FOR USE**

**Restraints**

DO NOT use if rainfall or irrigation is to occur within 8 hours of application.

DO NOT apply to crops undersown with legumes.

DO NOT apply to wheat before the 3-leaf stage (Z13).

DO NOT apply to wheat that is physically damaged (e.g. by hail, wind, insect attack).

DO NOT apply without surfactant/wetting agent.

DO NOT apply to paddocks where there is a high risk of weeds resistant to Group B herbicides.

DO NOT make more than one application of a Group B herbicide per season.

Note: Hussar will substantially reduce the growth of many weeds rather than give complete plant-kill. For directions on specific weeds, refer to the critical comments in the Directions for use tables.

**GRASSWEEDS**

Hussar is very active on annual ryegrass, annual phalaris and wild oats when used according to the Directions for use.

Hussar has also shown some weak activity on other grassweeds, such as brome grass, barley grass and silver grass, but the levels of control offered are not reliable or high enough to be able to make any claim of suppression.

**Annual ryegrass**

The level of weed control provided by Hussar is dependent on many factors, including growth conditions at spraying (soil moisture, temperature, humidity, frosts, etc.), efficiency of application (influenced by droplet size, total spray volume, equipment set-up, density or shading effect from the crop, etc.) and uptake of the herbicide into the plant (influenced by temperature, humidity, leaf characteristics, etc.). In addition, the weed stage and the population density will impact on final levels of weed control.

The trial results (1996 – 2002) suggest that Hussar offers excellent control of annual ryegrass, but that the level of control achieved was related to the size of the weed and/or the weed population in the crop at time of application.

When Hussar was applied at advanced growth stages of annual ryegrass, and/or to very dense populations of annual ryegrass, the level of control was unreliable.

The start of tillering has been shown as a stage at which an increase in the rate of Hussar is required for reliable control, and a weed population of 300 plants/m² has been set as the maximum limit for the use of Hussar.
Graph 1 demonstrates that when Hussar was applied to pre-tillering annual ryegrass at populations <300 plants/m², 150 g/ha provided mean control above 90% and in all trials control was better than 80%. The 200 g/ha rate offered slightly higher levels of control with improved reliability.

Once the population exceeded 300 plants/m², the level of control for all rates decreased to an unsatisfactory level. Hoegrass 375 1.0 L/ha demonstrated a high level of control for all rates decreased to an unsatisfactory level. Hussar 150 g/ha annual ryegrass (ARG) control: comparison across various weed stages and populations.

Graph 2: Summary of control of early-tillering (up to Z21,22) annual ryegrass with Hussar from 150 to 300 g/ha, across a range of weed densities, compared to Hoegrass 375 and Tristar Advance.

Summary of control of early-tillering (up to Z21–22) annual ryegrass with Hussar from 150 to 300 g/ha, across a range of weed densities, compared to Hoegrass 375 and Tristar Advance.

Hussar is seen to provide good control of annual ryegrass when applied outside the label Directions for use in some trials. However, in some trials (as is shown in Graph 3) Hussar has also performed very poorly in these off-label situations.

A number of trials show control of less than 90%, and in a proportion of them control dropped to less than 80%. Given those results, Hussar cannot be recommended for weeds larger than Z22.

Graph 3: Summary of control of mid-tillering (Z23+) annual ryegrass with Hussar from 150 to 300 g/ha, across a range of weed densities, compared to Hoegrass 375 and Tristar Advance.

Results from trials where Hussar was applied to annual ryegrass in early stages of tillering indicated that 200 g/ha gave more reliable control than 150 g/ha (although not clearly demonstrated in Graph 2, individual trial results indicate some anomalies in the results and these were accounted for in the label claim). Control from the 150 g/ha results were too variable and not sufficient to provide reliable control – as was the case for both the 150 g/ha and 200 g/ha rates when weed populations extended beyond 300 plants/m².

The recommended rate for Hussar in this situation is 200 g/ha, which performed similarly to the standard Tristar Advance 1.5 L/ha.

Graph 4: Hussar 150 g/ha annual ryegrass (ARG) control: comparison across various weed stages and populations.
The results shown in Graphs 4 & 5 reflect the influence of weed stage and weed density on control of annual ryegrass. Control of dense weed populations tends to be unreliable irrespective of the weed stage at spraying.

**Wild oats**

Field trials have demonstrated that there is a relationship between the level of weed control achieved and the size and density of the weeds. For this reason, limitations have been established for wild oat control. The 3-leaf stage has been adopted as the maximum growth stage at which Hussar will give reliable control. When using Hussar, it is important to monitor the wild oat situation to ensure the best results.

Control of weeds at growth stages larger than recommended on the label also tends to be less reliable, but it is when a dense population of large weeds are sprayed that there is a high likelihood of failure.

### Summary of control of pre-tillering (up to Z13) wild oats with Hussar from 100 to 300 g/ha, across a range of weed densities.

<table>
<thead>
<tr>
<th>Weed stage</th>
<th>Rate (g/ha)</th>
<th>Critical comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z11–13, &lt;150 plants/m²</td>
<td>Hussar 150 g/ha</td>
<td>Will substantially reduce the growth of wild oats and their ability to compete with the crop and will reduce seed set of wild oats but may not give a significant reduction in plant numbers.</td>
</tr>
<tr>
<td>Z11–13, &lt;150 plants/m²</td>
<td>Hussar 200 g/ha</td>
<td>Suppression of wild oats.</td>
</tr>
<tr>
<td>Z11–13, &lt;150 plants/m²</td>
<td>Hussar 300 g/ha</td>
<td>Will substantially reduce the growth of wild oats and their ability to compete with the crop and will reduce seed set of wild oats but may not give a significant reduction in plant numbers.</td>
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### Summary of control of early-tillering (up to Z21–22) wild oats with Hussar from 150 to 300 g/ha, across a range of weed densities, compared to Wildcat 110EC.

<table>
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<th>Weed stage</th>
<th>Rate (g/ha)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Z11–13, ≥150 plants/m²</td>
<td>Hussar 150 g/ha</td>
<td>Will substantially reduce the growth of wild oats and their ability to compete with the crop and will reduce seed set of wild oats but may not give a significant reduction in plant numbers.</td>
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<tr>
<td>Z11–13, ≥150 plants/m²</td>
<td>Hussar 300 g/ha</td>
<td>Will substantially reduce the growth of wild oats and their ability to compete with the crop and will reduce seed set of wild oats but may not give a significant reduction in plant numbers.</td>
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### Summary of control of pre-tillering (up to Z13) wild oats with Hussar from 100 to 300 g/ha, across a range of weed densities.

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<td>Suppression of wild oats.</td>
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### Summary of control of early-tillering (up to Z21–22) wild oats with Hussar from 150 to 300 g/ha, across a range of weed densities, compared to Wildcat 110EC.

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<tr>
<td>Z11–13, ≥150 plants/m²</td>
<td>Hussar 150 g/ha</td>
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</tr>
<tr>
<td>Z11–13, ≥150 plants/m²</td>
<td>Hussar 300 g/ha</td>
<td>Will substantially reduce the growth of wild oats and their ability to compete with the crop and will reduce seed set of wild oats but may not give a significant reduction in plant numbers.</td>
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<td>Suppression of wild oats.</td>
</tr>
<tr>
<td>Z11–13, ≥150 plants/m²</td>
<td>Hussar 300 g/ha</td>
<td>Will substantially reduce the growth of wild oats and their ability to compete with the crop and will reduce seed set of wild oats but may not give a significant reduction in plant numbers.</td>
</tr>
</tbody>
</table>

### Summary of control of early-tillering (up to Z21–22) wild oats with Hussar from 150 to 300 g/ha, across a range of weed densities, compared to Wildcat 110EC.

<table>
<thead>
<tr>
<th>Weed stage</th>
<th>Rate (g/ha)</th>
<th>Critical comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z11–13, ≥150 plants/m²</td>
<td>Hussar 150 g/ha</td>
<td>Will substantially reduce the growth of wild oats and their ability to compete with the crop and will reduce seed set of wild oats but may not give a significant reduction in plant numbers.</td>
</tr>
<tr>
<td>Z11–13, ≥150 plants/m²</td>
<td>Hussar 300 g/ha</td>
<td>Will substantially reduce the growth of wild oats and their ability to compete with the crop and will reduce seed set of wild oats but may not give a significant reduction in plant numbers.</td>
</tr>
</tbody>
</table>

### Summary of control of pre-tillering (up to Z13) wild oats with Hussar from 100 to 300 g/ha, across a range of weed densities.

<table>
<thead>
<tr>
<th>Weed stage</th>
<th>Rate (g/ha)</th>
<th>Critical comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z11–13, ≥150 plants/m²</td>
<td>Hussar 150 g/ha</td>
<td>Will substantially reduce the growth of wild oats and their ability to compete with the crop and will reduce seed set of wild oats but may not give a significant reduction in plant numbers.</td>
</tr>
<tr>
<td>Z11–13, ≥150 plants/m²</td>
<td>Hussar 200 g/ha</td>
<td>Suppression of wild oats.</td>
</tr>
<tr>
<td>Z11–13, ≥150 plants/m²</td>
<td>Hussar 300 g/ha</td>
<td>Will substantially reduce the growth of wild oats and their ability to compete with the crop and will reduce seed set of wild oats but may not give a significant reduction in plant numbers.</td>
</tr>
</tbody>
</table>

### Summary of control of early-tillering (up to Z21–22) wild oats with Hussar from 150 to 300 g/ha, across a range of weed densities, compared to Wildcat 110EC.

<table>
<thead>
<tr>
<th>Weed stage</th>
<th>Rate (g/ha)</th>
<th>Critical comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z11–13, ≥150 plants/m²</td>
<td>Hussar 150 g/ha</td>
<td>Will substantially reduce the growth of wild oats and their ability to compete with the crop and will reduce seed set of wild oats but may not give a significant reduction in plant numbers.</td>
</tr>
<tr>
<td>Z11–13, ≥150 plants/m²</td>
<td>Hussar 300 g/ha</td>
<td>Will substantially reduce the growth of wild oats and their ability to compete with the crop and will reduce seed set of wild oats but may not give a significant reduction in plant numbers.</td>
</tr>
</tbody>
</table>
Graph 8: Hussar 150g/ha wild oat control comparison across various weed stages and populations.

Graph 9: Hussar 200g/ha wild oat control comparison across various weed stages and populations.

Both advanced weed stages and high populations can reduce control, and once larger weeds and high populations occur together there is a compounding effect that reduces weed control to an unsatisfactory level.

The variation in results, as demonstrated by the high/low range bars, increased with greater weed populations and later growth stages, which is why there is no label claim for these use patterns.

Annual phalaris (paradoxa grass)

Annual phalaris is well controlled by Hussar, and in commercial use Hussar has been seen to give control at least as good as that of the standard herbicides (i.e. Wildcat).

As with wild oats and annual ryegrass, results from trials have suggested that control of annual phalaris is poorer when Hussar is applied at advanced growth stages and/or to very dense populations of annual phalaris. The start of tillering has been shown as the stage at which control with Hussar becomes unreliable, and a weed population of 300 plants/m² has been set as the weed density limit for the use of Hussar.

**Graph 10**: Summary of control of pre-tillering (Z11–13) annual phalaris with Hussar from 100 to 300 g/ha, across a range of weed densities.

The rate for control of phalaris with Hussar is 200 g/ha, with a growth stage range of Z11 to Z13.

Hussar at 150 g/ha in many situations gave control comparable to or approaching that of 200 g/ha. This rate is registered for suppression of phalaris.
Other grasses

Hussar has some activity on a number of other grass weeds for which no label claim is made.

The weeds specific to Australian cropping situations that Hussar was tested against were brome grass, barley grass and silver grass.

Hussar shows some herbicidal activity on these species, but the level of activity was too low to support even a suppression claim. In some trials no effect from Hussar was evident.

Once annual phalaris starts to tiller, both the level and the reliability of control are reduced to a level which cannot sustain a label claim.

Whilst Hussar gave control at least comparable to that of Wildcat 110 EC at standard rates when applied according to label recommendations, Wildcat 110 EC is registered for use on larger weeds and over a wider range of crop growth stages.

It is important to consider the number of trials in the >300 plants/m² columns. It is clearly understood with Hussar that both weed stage and population have a significant effect on reducing the level of weed control, and this also applies to annual phalaris. For reliable results, the Hussar 200 g/ha rate should be used before tillering.

**GRAPH 11:** Summary of control of early-tillering (Z21–22) annual phalaris with Hussar from 100 to 300 g/ha, across a range of weed densities, compared to Wildcat 110 EC.

**GRAPH 12:** Hussar 150 g/ha annual phalaris control comparison across various weed stages and populations.

**GRAPH 13:** Hussar 200 g/ha annual phalaris control comparison across various weed stages and populations.
**Graph 15:** Hussar 200 g/ha – Barley grass control.

**Graph 16:** Hussar 200 g/ha – Silver grass control.

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**Broadleaf Weeds**

The key attribute of Hussar in offering both grass and broadleaf weed control makes it unique in the range of post-emergent grassweed herbicides.

Hussar exhibits activity on a wide range of broadleaf weeds, and it has demonstrated high levels of activity on the cruciferous (or brassica) range of weeds – which constitutes a major portion of the weed mix in Australia.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Weed</th>
<th>State</th>
<th>Weed stage</th>
<th>Rate (ha)</th>
<th>Critical comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>Charlock (Sinapis arvensis)</td>
<td>All</td>
<td>Cotyledon to 8-leaf</td>
<td>150 g</td>
<td>Will not control weeds resistant to Group B herbicides.</td>
</tr>
<tr>
<td></td>
<td>Clver (Trifolium spp.)</td>
<td>All</td>
<td>Cotyledon to 6-leaf</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Deadnettle (Lamium amplexicaule)</td>
<td>All</td>
<td>Cotyledon to 4-leaf</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Doublegeee, spiny emex, three-corner jack (Emex australis)</td>
<td>All</td>
<td>Cotyledon to 4-leaf</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fumitory, denselower (Fumaria densiflora), fumitory, wall (Fumaria muralis)</td>
<td>All</td>
<td>Cotyledon to 4-leaf</td>
<td>150 g</td>
<td>Not all fumitory species are adequately controlled with Hussar. Ensure species identification is correct before applying Hussar.</td>
</tr>
<tr>
<td></td>
<td>Indian hedge mustard (Siumbrum orientale)</td>
<td>All</td>
<td>2 to 6-leaf</td>
<td></td>
<td>Will not control weeds resistant to Group B herbicides.</td>
</tr>
<tr>
<td></td>
<td>Lupins (volunteer) (Lupinus angustifolius)</td>
<td>All</td>
<td>Cotyledon to 4-leaf</td>
<td></td>
<td>Lupins that emerge after application will not be controlled.</td>
</tr>
<tr>
<td></td>
<td>Medic (Medicago spp.)</td>
<td>All</td>
<td>Cotyledon to 4-leaf</td>
<td></td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Paterson’s curse, Riverina bluebell, Salvation Jane (Echium plantagineum)</td>
<td>All</td>
<td>2 to 6-leaf</td>
<td>200 g</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Shepherd’s purse (Capsella bursa-pastoris)</td>
<td>All</td>
<td>2 to 8-leaf</td>
<td></td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Turnip weed (Raphistrum rugosum)</td>
<td>All</td>
<td>Cotyledon to 6-leaf</td>
<td></td>
<td>Will not control weeds resistant to Group B herbicides.</td>
</tr>
<tr>
<td></td>
<td>Wild radish (Raphalus raphanistrum)</td>
<td>All</td>
<td>Cotyledon to 4-leaf</td>
<td>200 g</td>
<td>Heavy populations (&gt;50 plants/m²) or those suffering moisture stress may not be adequately controlled. A follow-up application of a suitable herbicide may be required to control remaining plants or plants that emerge after application. Will not control weeds resistant to Group B herbicides.</td>
</tr>
<tr>
<td></td>
<td>Winweed, hogweed (Polygonum aviculare), tree hogweed (Polygonum patulum)</td>
<td>All</td>
<td>Cotyledon to 4-leaf</td>
<td>150 g</td>
<td>–</td>
</tr>
</tbody>
</table>
Cruciferous/brassica weeds

Hussar has demonstrated differing levels of activity on the various cruciferous weeds.

Indian hedge mustard (IHM) and charlock, up to the 6 and 8-leaf stages respectively, have been found to be easily controlled at the 150 g/ha rates, whereas the 200 g/ha rate is required for more reliable control of wild radish up to the 4-leaf stage.

Wild radish

Recognised as one of the leading broadleaf weeds, wild radish is often part of the weed mix. Hussar offers very good control of wild radish up to the 4-leaf stage, and where the weed populations are <50 plants/m².

Where known Group B resistance to wild radish or other identified cruciferous weeds exists, Hussar will not provide adequate levels of control, and an alternative herbicide such as Tigrex should be used.

Other broadleaf weeds

Since the start of the development program for Hussar, its activity on many broadleaf weeds has been researched. Many of these weeds have already been registered for either suppression or control by Hussar. However the number of replicated trials conducted for many weeds has not been sufficient to submit for registration, and in some cases the activity of Hussar was not considered satisfactory for claiming either weed control or suppression.

The table overleaf has been included to demonstrate the broad levels of weed control that were recorded in these trials, and to indicate those situations for which no data has yet been recorded.
## Broadleaf weed activity with Hussar

<table>
<thead>
<tr>
<th>Common name</th>
<th>Latin name</th>
<th>Control rating 1-4 Hussar</th>
<th>No. of trials – Hussar</th>
<th>Reg. status</th>
<th>Hussar comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Common name</strong></td>
<td><strong>Latin name</strong></td>
<td><strong>Control rating 1-4 Hussar</strong></td>
<td><strong>No. of trials – Hussar</strong></td>
<td><strong>Reg. status</strong></td>
<td><strong>Hussar comments</strong></td>
</tr>
<tr>
<td>African turnip weed (Qld)</td>
<td>Sisymbrium arvense</td>
<td>N/A</td>
<td>0</td>
<td>N</td>
<td>No data</td>
</tr>
<tr>
<td>Argentine peppergrass</td>
<td>Leptidium amplexicaule</td>
<td>4</td>
<td>1</td>
<td>Y</td>
<td>Registered for control at 200 g/ha</td>
</tr>
<tr>
<td>Ball mustard (SA)</td>
<td>Nasturtium officinale</td>
<td>N/A</td>
<td>0</td>
<td>N</td>
<td>No data</td>
</tr>
<tr>
<td>Bedstraw</td>
<td>Galium tricornutum</td>
<td>3</td>
<td>N/A</td>
<td>Y</td>
<td>Registered for suppression at 150 g/ha</td>
</tr>
<tr>
<td>Bifora</td>
<td>Bifora testiculata</td>
<td>2</td>
<td>1</td>
<td>Y</td>
<td>Early suppression but poor control and did not eliminate seed set</td>
</tr>
<tr>
<td>Bindweed</td>
<td>Fallopia convolvulus</td>
<td>3</td>
<td>N/A</td>
<td>Y</td>
<td>Registered for suppression at 150 g/ha. Will not control weeds resistant to Group B herbicides.</td>
</tr>
<tr>
<td>Bishop’s weed</td>
<td>Anemone majus</td>
<td>4</td>
<td>1</td>
<td>Y</td>
<td>Registered for suppression at 150 g/ha. Will not control weeds resistant to Group B herbicides.</td>
</tr>
<tr>
<td>Bittercress</td>
<td>Coronopus didymus</td>
<td>4</td>
<td>1</td>
<td>Y</td>
<td>May have useful control, but more data required</td>
</tr>
<tr>
<td>Beggabri weed (Qld)</td>
<td>Amaranthus macrocarpus</td>
<td>N/A</td>
<td>0</td>
<td>N</td>
<td>No data</td>
</tr>
<tr>
<td>Bur medic</td>
<td>Medicago polymorpha</td>
<td>4</td>
<td>N/A</td>
<td>Y</td>
<td>Registered for suppression at 150 g/ha (see medic)</td>
</tr>
<tr>
<td>Californite daisy (SA)</td>
<td>Pentzia sulfuricosa</td>
<td>N/A</td>
<td>0</td>
<td>N</td>
<td>No data</td>
</tr>
<tr>
<td>Canola</td>
<td>Brassica napus</td>
<td>4</td>
<td>1</td>
<td>Y</td>
<td>Excellent control indicated, more data required</td>
</tr>
<tr>
<td>Cape tulp</td>
<td>Horexia spp.</td>
<td>3</td>
<td>N/A</td>
<td>Y</td>
<td>Registered for suppression at 150 g/ha</td>
</tr>
<tr>
<td>Capeweed</td>
<td>Anacocha calendula</td>
<td>2</td>
<td>1</td>
<td>N</td>
<td>Consistently poor or no control</td>
</tr>
<tr>
<td>Charlock</td>
<td>Sinapis arvensis</td>
<td>4</td>
<td>N/A</td>
<td>Y</td>
<td>Registered for control at 150 g/ha. Will not control weeds resistant to Group B herbicides.</td>
</tr>
<tr>
<td>Chick pea</td>
<td>Cicero arietinum</td>
<td>N/A</td>
<td>0</td>
<td>N</td>
<td>No data</td>
</tr>
<tr>
<td>Chickweed</td>
<td>Caltropia media</td>
<td>N/A</td>
<td>0</td>
<td>N</td>
<td>No data</td>
</tr>
<tr>
<td>Chicory</td>
<td>Cichorium intybus</td>
<td>N/A</td>
<td>0</td>
<td>N</td>
<td>No data</td>
</tr>
<tr>
<td>Clover</td>
<td>Trifolium spp.</td>
<td>4</td>
<td>N/A</td>
<td>Y</td>
<td>Registered for control at 150 g/ha</td>
</tr>
<tr>
<td>Common vetch</td>
<td>Vicia saliva</td>
<td>3</td>
<td>5</td>
<td>Y</td>
<td>Registered for suppression at 150 g/ha</td>
</tr>
<tr>
<td>Cornvolvulus buckwheat</td>
<td>Corvolvulus arvensis</td>
<td>3</td>
<td>1</td>
<td>Y</td>
<td>Poor control</td>
</tr>
<tr>
<td>Cotterand</td>
<td>Corlandium sativum</td>
<td>4</td>
<td>1</td>
<td>Y</td>
<td>Registered for suppression at 150 g/ha</td>
</tr>
<tr>
<td>Crassula</td>
<td>Crassula colorata</td>
<td>3</td>
<td>1</td>
<td>Y</td>
<td>Registered for suppression at 150 g/ha</td>
</tr>
<tr>
<td>Crow garlic</td>
<td>Allium vineale</td>
<td>N/A</td>
<td>0</td>
<td>N</td>
<td>No data</td>
</tr>
<tr>
<td>Deadnettle</td>
<td>Lamiun ampelopsis</td>
<td>4</td>
<td>N/A</td>
<td>Y</td>
<td>Good consistent control, registered at 150 g/ha</td>
</tr>
<tr>
<td>Dense-flowered thistle</td>
<td>Fumaria densiflora</td>
<td>4</td>
<td>N/A</td>
<td>Y</td>
<td>Registered for control at 150 g/ha</td>
</tr>
</tbody>
</table>

### Hussar comments

- **Control rating 1-4 Hussar**: 1 = No control (no activity recorded); 2 = Poor control (some activity recorded, but insignificant); 3 = Suppression (useful suppression of growth (80%), sufficient for a label claim); 4 = Control (good efficacy, control above 90%)
- **No. of trials – Hussar**: Number of trials conducted
- **Reg. status**: N = Not applicable; Y = Registered for control; N/A = No data

### Hussar Activity

- **Doublegee**: Eremex australis
  - Activity: Suppression
  - Remarks: Registered for control at 200 g/ha
- **Faba beans**: Vicia faba
  - Activity: Control
  - Remarks: Good control, with further trials required for registration
- **Fat hen**: Chenopodium album
  - Activity: No data
- **Fumitory**: Fumaria bastarda
  - Activity: Controlled at 150 g/ha
- **Fumitory**: F. densiflora
  - Activity: Y
  - Remarks: Generally good control. Registered at 150 g/ha.
- **Geranium**: Erodium bolitrosa
  - Activity: Poor control
- **Geranium**: Erodium cicutarium
  - Activity: Y
  - Remarks: Poor control
- **Hoary cress**: Cardaria draba
  - Activity: N/A
  - Remarks: Observations indicate no useful control
- **Horehound**: Marrubium vulgare
  - Activity: N
  - Remarks: Limited data indicates this weed may be well controlled.
- **Indian hedge mustard**: Sisymbrium orientale
  - Activity: N/A
  - Remarks: Registered for control at 150 g/ha. Will not control weeds resistant to Group B herbicides.
- **Ivy-leaf speedwell**: Veronica hederifolia
  - Activity: Y
  - Remarks: Poor control
- **Lincoln weed (SA)**: Diploptera punkanesis
  - Activity: N/A
  - Remarks: No data
- **Longfruited turnip**: Brassica trunforfolia
  - Activity: N/A
  - Remarks: Excellent control, more data required for registration. Will not control weeds resistant to Group B herbicides.
- **Loosestrife**: Lythrum hyssopifolia
  - Activity: N
  - Remarks: Control/suppression, occurs as secondary weed
- **Lupins**: Lupinus angustifolius
  - Activity: N/A
  - Remarks: Good control, registered at 150 g/ha.
- **Malice catchly**: Silene spp.
  - Activity: N/A
  - Remarks: No data
- **Maltese cockspur**: Centaurea melitensis
  - Activity: N
  - Remarks: No control
- **Marshmallow**: Malva parviflora
  - Activity: Y
  - Remarks: Poor control
- **Medic spp.**: Medicago spp.
  - Activity: N/A
  - Remarks: Registered for medic ssp control at 150 g/ha.
- **Mexican poppy**: Argemone spp.
  - Activity: N/A
  - Remarks: Suppression only, unlikely to meet registration requirements
- **Musk weed**: Myagrum portulatum
  - Activity: N
  - Remarks: Good control suggested, more data required
- **Mustard**: Sisymbrium officinale
  - Activity: N/A
  - Remarks: No data
- **New Zealand spinach (Qld)**: Tetragonia tetragonioides
  - Activity: N
  - Remarks: Good control suggested, more data required
- **Peas**: Pisum sativum
  - Activity: N/A
  - Remarks: Registered for suppression at 150 g/ha
- **Poppies**: Papaver dubium
  - Activity: Y
  - Remarks: Good control
- **Prickly lettuce**: Lactuca serriola
  - Activity: Y
  - Remarks: Good control, possible registration, with additional trials. Will not control weeds resistant to Group B herbicides.
- **Rough poppies**: Papaver hybridum
  - Activity: N/A
  - Remarks: No data
- **Saltbush**: Atriplex spp.
  - Activity: N/A
  - Remarks: No data
- **Salvation Jane**: Echium plantagineum
  - Activity: Y
  - Remarks: Registered for control at 200 g/ha
- **Sheep weed**: Bipolaris ovoides
  - Activity: Y
  - Remarks: Registered for suppression at 150 g/ha
Comparison of grass + broadleaf herbicide mixtures with Hussar

Trials have demonstrated that when mixing broadleaf herbicides (such as MCPA LVE and Tigrex) with selective grass herbicides, (such as Tristar Advance, Achieve, Wildcat 110 EC and Topik®), there can be antagonism to the grassweed control, particularly for wild oats and annual ryegrass. The loss of efficacy can be as high as 5 to 10% – as is often reflected in the label compatibility claims.

This is not uncommon in weed management, and is considered an acceptable compromise in order to achieve one-pass weed control.

In order to measure the usefulness of Hussar as an economical alternative for combined broadleaf and grassweed control, it is important to compare the grassweed control of Hussar with that of a tank-mixed broadleaf and grass herbicide combination.

The data in Graph 19 demonstrates that when Hussar is used as recommended it offers wild oat control at least as good as, and in many cases better than that of Tristar Advance tank-mixed with Tigrex.

However, crop stage and weed stage are important factors to consider when deciding upon a herbicide option. The grassweed and broadleaf herbicide mix may have a greater window of application than Hussar.

Generally the annual phalaris specific herbicides, such as Wildcat 110 EC and Topik, lose a significant level of efficacy on annual phalaris when tank-mixed with a broadleaf herbicide. In this situation, Hussar offers an improved level of annual phalaris control as well as control of an extensive range of broadleaf weeds.

**Note:** This table is intended as a guide only. Bayer Cropscience does not support the use of Hussar on weeds which are not registered on the product label. These weeds may not be satisfactorily controlled or suppressed by Hussar.

### Table: Comparison of grass + broadleaf herbicide mixtures with Hussar

<table>
<thead>
<tr>
<th>Common name</th>
<th>Latin name</th>
<th>Control rating 1–4 Hussar</th>
<th>Hussar comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shepherd’s purse</td>
<td>Capsella bursa-pastoris</td>
<td>4</td>
<td>Good control, registered at 150 g/ha</td>
</tr>
<tr>
<td>Short/fruiting burr</td>
<td>Raphistrum raphanistrum</td>
<td>4</td>
<td>Registered for control at 150 g/ha. Will not control weeds resistant to Group B herbicides.</td>
</tr>
<tr>
<td>Skeleton weed</td>
<td>Chondrilla juncea</td>
<td>3</td>
<td>Good control late, suspect this result not reliable</td>
</tr>
<tr>
<td>Slender thistle</td>
<td>Centaurea cyanus</td>
<td>N/A</td>
<td>Good control, no data</td>
</tr>
<tr>
<td>Smallflowered fumitory</td>
<td>Fumaria parviflora</td>
<td>2</td>
<td>Poor control</td>
</tr>
<tr>
<td>Small medic</td>
<td>Medicago minima</td>
<td>4</td>
<td>Registered for Medicago spp. control at 150 g/ha</td>
</tr>
<tr>
<td>Sorrel</td>
<td>Rumex acetosella</td>
<td>N/A</td>
<td>Registered for suppression at 200 g/ha. Will not control weeds resistant to Group B herbicides.</td>
</tr>
<tr>
<td>Sour sob</td>
<td>Osalis pes-caprae</td>
<td>3</td>
<td>Good control, no data on control of bulb formation</td>
</tr>
<tr>
<td>Sow thistle</td>
<td>Sonchus oleraceus</td>
<td>3</td>
<td>Registered for suppression at 200 g/ha. Will not control weeds resistant to Group B herbicides.</td>
</tr>
<tr>
<td>Spear thistle</td>
<td>Cirsium vulgare</td>
<td>N/A</td>
<td>Good control, no data</td>
</tr>
<tr>
<td>Spoon cudweed</td>
<td>Sturtartia mueller</td>
<td>3</td>
<td>Suppression only</td>
</tr>
<tr>
<td>Spreading night phlox</td>
<td>Zaluziansky deserti</td>
<td>2</td>
<td>Variable results</td>
</tr>
<tr>
<td>St Barnaby’s thistle</td>
<td>Centaurea solstitialis</td>
<td>2</td>
<td>Poor control</td>
</tr>
<tr>
<td>Staggers weed</td>
<td>Stachys arvensis</td>
<td>N/A</td>
<td>Good control suggested, more data required</td>
</tr>
<tr>
<td>Sterile thistle</td>
<td>Onopordum acuatum</td>
<td>4</td>
<td>Registered for suppression at 150 g/ha. Species not well identified</td>
</tr>
<tr>
<td>Stinging nettle</td>
<td>Urtica urens/incisa</td>
<td>4</td>
<td>Good control suggested, more data required</td>
</tr>
<tr>
<td>Stonecrop</td>
<td>Crassula spp.</td>
<td>N/A</td>
<td>Registered for suppression at 150 g/ha. Species not well identified</td>
</tr>
<tr>
<td>Sub clover</td>
<td>Tritium australis</td>
<td>4</td>
<td>Registered for control at 150 g/ha</td>
</tr>
<tr>
<td>Three-cornered jack</td>
<td>Eremus australis</td>
<td>N/A</td>
<td>Registered for control at 200 g/ha</td>
</tr>
<tr>
<td>Treadrush</td>
<td>Juncais bufonius</td>
<td>3</td>
<td>Registered for suppression at 150 g/ha</td>
</tr>
<tr>
<td>Tree hogweed</td>
<td>Polygonum patulum</td>
<td>4</td>
<td>Registered for control at 150 g/ha</td>
</tr>
<tr>
<td>Turnip weed</td>
<td>Brassica rapa</td>
<td>N/A</td>
<td>Registered for control at 150 g/ha</td>
</tr>
<tr>
<td>Variegated thistle</td>
<td>Sibbium matricaria</td>
<td>3</td>
<td>Variable results</td>
</tr>
<tr>
<td>Vetches, tares</td>
<td>Vicia spp.</td>
<td>4</td>
<td>Registered for control at 150 g/ha</td>
</tr>
<tr>
<td>Wall fumitory</td>
<td>Fumaria muralis</td>
<td>N/A</td>
<td>Registered for control at 150 g/ha</td>
</tr>
<tr>
<td>Ward’s weed</td>
<td>Camphirea annua</td>
<td>4</td>
<td>Registered for control at 150 g/ha</td>
</tr>
<tr>
<td>Wild radish</td>
<td>Raphanus raphanistrum</td>
<td>4</td>
<td>Registered for control at 200 g/ha. Will not control weeds resistant to Group B herbicides.</td>
</tr>
<tr>
<td>Wire weed</td>
<td>Polygonum aviculare</td>
<td>4</td>
<td>Registered for control at 150 g/ha</td>
</tr>
<tr>
<td>Wooly bur medic</td>
<td>Medicago minima</td>
<td>N/A</td>
<td>Registered for Medicago spp. control at 150 g/ha (see medic)</td>
</tr>
<tr>
<td>Yellow burnweed</td>
<td>Amnikola intermedia</td>
<td>N/A</td>
<td>No data</td>
</tr>
</tbody>
</table>

Note: This table is intended as a guide only. Bayer Cropscience does not support the use of Hussar on weeds which are not registered on the product label. These weeds may not be satisfactorily controlled or suppressed by Hussar.

**GRAPH 19:** Comparing wild oat control from grass + broadleaf herbicide mixtures and Hussar.


**CROP SAFETY**

The effects of Hussar on wheat have been closely evaluated throughout the development of the product. This includes assessment of any crop phytotoxicity, crop stunting and impact on yield.

There is additional information on crop safety in the ‘Compatibility’ section (which examines the effects on crop safety when Hussar is mixed with a broadleaf herbicide) and the ‘Surfactant’ section (which reviews the use of wetting agents versus oils).

Hussar has been tested on numerous wheat varieties across 9 seasons in over 150 trials. In most trials Hussar exhibited a slight to moderate crop effect, registering a rating of 10–20%, which indicates a slight yellowing was just visible, with a minor biomass reduction. Only 2–3% of all trials have been shown to exceed a crop-effect rating of 30%.

The effect on crop yield of this initial discoloration and, in some trials, reduction in growth following application of Hussar was studied in detail at 11 trial sites.

In all of these situations the crop recovered, and the yield from these trials was equivalent to the standard or control used in the trials.

The following graphs highlight the level of effect by comparing Hussar at the recommended rate 200 g/ha and double this rate: 400 g/ha.

The higher rate often resulted in an increased level of crop effect, but in all instances this level of effect is within acceptable limits, and this is reflected in the similar yields between the 2 rates.

### Crop effect rating linear scale 0-100

<table>
<thead>
<tr>
<th>Crop effect rating</th>
<th>1999 51 trial sites</th>
<th>1998 62 trial sites</th>
<th>1997 33 trial sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>No crop effects</td>
<td>2%</td>
<td>8%</td>
<td>6%</td>
</tr>
<tr>
<td>Ratings 1–9 at all rates of 200 g/ha and less</td>
<td>14%</td>
<td>21%</td>
<td>24%</td>
</tr>
<tr>
<td>Ratings 10–19 at all rates of 200 g/ha and less</td>
<td>55%</td>
<td>48%</td>
<td>45%</td>
</tr>
<tr>
<td>Crop effects of 20–29, at any rate of 200 g/ha and less</td>
<td>27%</td>
<td>21%</td>
<td>21%</td>
</tr>
<tr>
<td>Crop effects of 30 or greater</td>
<td>2%</td>
<td>2%</td>
<td>3%</td>
</tr>
</tbody>
</table>

The following rating criteria are used to visually assess crop effects:

**a) Crop discolouration (chlorosis, etc.):**

- A rating scale of 0-100, where:
  - 0 = No discolouration evident
  - 10 = Negligible, discolouration barely seen
  - 20 = Slight, discolouration clearly seen
  - 30 = Moderate discolouration, recovery expected
  - 40 = Substantial discolouration, some effects probably irreversible
  - 50 = Majority of plants discoloured, effects highly likely to be irreversible
  - 60 = Nearly all plants discoloured, mostly irreversibly
  - 70 = Severe discolouration
  - 80 = Increasing level of discolouration
  - 90 = Increasing level of discolouration
  - 100 = Total discolouration of crop

A rating of 40 or above is commercially unacceptable.

**b) Crop stunting (biomass reduction), thinning or distortion:**

- A rating scale of 0-100, where:
  - 0 = No damage evident
  - 10 = Negligible damage, ~10% biomass reduction or thinning
  - 20 = Slight damage, ~20% biomass reduction or thinning
  - 30 = Moderate damage, ~30% biomass reduction or thinning
  - 40 = Substantial damage, ~40% biomass reduction or thinning
  - 50 = Majority of plants damaged, some necrosis and distortion, ~50% biomass reduction or thinning
  - 60 = Nearly all plants damaged, substantial necrosis and distortion, ~60% biomass reduction or thinning
  - 70 = Severe damage, much necrosis and distortion, 70% biomass reduction or thinning
  - 80 = Very severe, ~80% biomass reduction or thinning
  - 90 = 90% biomass reduction or thinning
  - 100 = Complete loss of plant (or) crop yield

A rating of 30 or above is commercially unacceptable.

The above graphs indicate that Hussar is likely to cause some crop effect, but under normal growing conditions these effects are transient and yields are not reduced.

---

The following rating criteria are used to visually assess crop effects:

**a) Crop discolouration (chlorosis, etc.):**

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  - 100 = Complete loss of plant (or) crop yield

A rating of 30 or above is commercially unacceptable.

The above graphs indicate that Hussar is likely to cause some crop effect, but under normal growing conditions these effects are transient and yields are not reduced.
Crop safety factors to be considered

There are various other factors which can also influence the level of crop effect associated with Hussar.

To help ensure Hussar has minimal crop effects, the following guidelines should be followed:

- Wheat should be at or beyond the 3-leaf stage (Z13 growth stage) before application of Hussar.
- Do not apply to wheat that is physically damaged (e.g. by hail, wind, insect attack).
- Do not overlap when spraying or double spray corners.
- Application to very sandy soils followed by soaking rainfall may cause significant crop effects.
- Growth retardation will be increased if the crop is affected by root disease (e.g. cereal cyst nematode, maize cyst, take-all [haydie]), nutritional stress, waterlogging, drought stress, excessively cold conditions or previous herbicide treatment.
- Crop damage will be increased in highly alkaline soils (soil pH > 8.5) as determined by soil-in-water suspension.
- Do not apply to crops not actively growing because of cold and wet conditions or drought stress.
- Do not apply to wheat before this stage could result in a higher level of crop damage than indicated above.

Wheat growth stages

The key crop safety factor to consider when applying Hussar to wheat is to ensure that the crop has at least reached the 3-leaf stage. An application of Hussar to wheat before this stage could result in a higher level of crop damage than indicated above.

Wheat:

Hussar has been tested on a large number of different wheat types and varieties. No varieties have been considered not tolerant to Hussar.

Barley:

The crop safety of Hussar on barley varieties is yet to be fully evaluated.
**RE-CROPPING**

Hussar is known to have some soil activity, and residues can remain in the soil for various lengths of time depending on the soil conditions. These residues may potentially impact on the following season’s crop. The key elements which influence the residual behaviour in the soil are soil moisture and temperature, microbial activity and the pH of the soil. Microbial activity is the major pathway for the degradation of the active ingredient in soil under field conditions. Because of its versatility, Hussar has been tested in numerous crop rotation trials and the following minimum re-cropping intervals apply for the listed crops following application of Hussar.

**Label advice**

The following re-cropping intervals are not yet approved or supported by label claims and should be considered preliminary data only.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Minimum re-cropping interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>1 day</td>
</tr>
<tr>
<td>Barley</td>
<td>9 months</td>
</tr>
<tr>
<td>Oats</td>
<td>9 months</td>
</tr>
<tr>
<td>Artichoke</td>
<td>9 months</td>
</tr>
<tr>
<td>Faba beans</td>
<td>9 months</td>
</tr>
<tr>
<td>Canola</td>
<td>9 months</td>
</tr>
<tr>
<td>Chicpeas</td>
<td>9 months</td>
</tr>
<tr>
<td>Lupins</td>
<td>9 months</td>
</tr>
<tr>
<td>Lucerne, clover</td>
<td>9 months (in higher pH soils and at the lower rainfall limit some discolouration may occur)</td>
</tr>
<tr>
<td>Peas</td>
<td>9 months</td>
</tr>
<tr>
<td>Vetch</td>
<td>9 months</td>
</tr>
<tr>
<td>Medic</td>
<td>21 months</td>
</tr>
<tr>
<td>Lentils</td>
<td>21 months</td>
</tr>
</tbody>
</table>

*Refer also to ‘other factors influencing crop rotations’*

**New research**

The following re-cropping intervals are not yet approved or supported by label claims and should be considered preliminary data only.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Minimum re-cropping interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton*</td>
<td>12 months</td>
</tr>
<tr>
<td>Maize*</td>
<td>12 months</td>
</tr>
<tr>
<td>Mungbeans*</td>
<td>12 months</td>
</tr>
<tr>
<td>Sorghum*</td>
<td>12 months</td>
</tr>
<tr>
<td>Soybeans*</td>
<td>12 months</td>
</tr>
<tr>
<td>Sunflowers*</td>
<td>12 months</td>
</tr>
</tbody>
</table>

*Application has been made for approval of these claims. At the time of publication these claims were not approved.

**Other factors influencing crop rotations**

- The application of a Group B herbicide in the crop following an application of Hussar may result in increased crop effects. (Consult the manufacturer of Hussar for advice in these situations.)
- Rainfall of less than 250 mm following Hussar use may result in extended re-cropping intervals for winter crops sown in the following season. Patchy rain, with extended dry periods may result in extended re-cropping intervals, even when rainfall exceeds 250 mm. If in doubt, seek specialist advice.
- Rainfall of less than 500 mm following Hussar use may result in extended re-cropping intervals for summer crops sown in the following year.
- Use of Hussar on soils with a pH greater than 8.5 (soil in water) has not been extensively tested and is not recommended.

For advice on crops not listed above, contact your local reseller agronomist, or the manufacturer: Bayer CropScience Pty Ltd.

**COMPATIBILITY**

**Herbicides**

Hussar may be mixed with Lontrel® without any loss of efficacy or adverse crop effects. Further compatibilities are under investigation.

Do not mix Hussar with the following herbicides, as decreased efficacy on grassweeds and/or crop injury may occur:

- Bromoxynil MCPA (e.g. Bromicide® MA, Buctril® MA)
- Tigrex
- MCPA LVE
- Igran®
- Other sulfonylurea herbicides

**Graph 24: Crop effects with Hussar + MCPA LVE.**

**Graph 25: Crop effects with Hussar when tank-mixed with a broadleaf herbicide.**

Graph 24 indicates the variability of results when tank-mixing MCPA LVE herbicide with Hussar. In most situations MCPA LVE significantly increased the level of crop effect. The shaded area highlights threshold levels of crop effect which would be considered severe.

Tank-mixes of Hussar with Tigrex, Igran or Buctril MA as indicated in Graph 25 also show the potential to increase crop damage. At both 150 g/ha and 200 g/ha of Hussar, crop-effect increases were recorded.
**Surfactants**

Hussar must always be applied with the addition of a surfactant such as a non-ionic wetting agent (e.g. BS 1000 at 0.25% v/v) or Hasten® (at 1% v/v), even when tank-mixing with other products.

Trials have demonstrated little difference between the performance of wetters (i.e. BS 1000) and crop spray oils (i.e. Hasten), both in regard to weed control and crop safety as reflected in crop yields.

**Fungicides**

Hussar is physically compatible with Folinc® and Bayleton®, however constant agitation is required to alleviate settling.

For advice on mixing with other fungicides please contact your local Bayer CropScience representative.

**Foliar Fertilisers**

As Graph 26 illustrates, the addition of zinc based foliar fertilisers to Hussar can reduce wild oat control to unacceptable levels. Various brands of zinc based foliar fertilisers are available however most are based on zinc sulphate, zinc chelate or zinc oxide forms which were used in the trial below.

Hussar must not be mixed with zinc based foliar fertilisers as a loss of efficacy can occur.

**Graph 26:** Comparisons when zinc is added to Hussar.

**Graph 27:** Surfactant comparison – Hussar and weed control.

**Graph 28:** Surfactant comparison – Hussar and crop yields.

---

**Insecticides**

Hussar is physically compatible with Le-mat®.

Hussar must not be mixed with chlorpyrifos-based formulations as unacceptable crop effects may occur.

For advice on mixing with other insecticides please contact your local Bayer CropScience representative.

**Insecticides**

Hussar is physically compatible with Le-mat®.

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For advice on mixing with other insecticides please contact your local Bayer CropScience representative.
APPLICATION

Hussar is a selective sulfonylurea herbicide. It is predominantly a foliar herbicide with limited activity through the soil. Hussar will not reliably control weeds that emerge after spraying. Best results are achieved under good growing conditions, and application to weeds or crops under stress should be avoided.

Ensure that complete and even spray coverage of all weeds is achieved.

Mixing

Half-fill the spray tank with water, then – with agitators in motion – add the correct amount of Hussar directly into the spray tank. Add any other compatible herbicide, then wetting agent or crop oil as recommended. Finish filling the tank with agitators in motion. Agitation must continue before and during spraying.

Equipment

Ground sprayers: Standard boom sprayers only are recommended, and must be fitted with by-pass or mechanical agitation. It is recommended that 50 to 80 L water/ha is applied as a fine/medium spray as defined by the ASAE S572 standard.

Aircraft: Do not apply Hussar by aircraft. Application by aircraft is not recommended because of the high potential for off-target damage and possible reduced efficacy.

Irrigated crops

Prevent waterlogging and run-off situations.

Do not irrigate the field on the day before or after treatment with Hussar.

Do not apply Hussar through irrigation equipment.

Rainfastness

Hussar has a rain-fast period of 8 hours.

When plants are dry, most of the uptake of the active ingredient occurs in the first 2 hours after application. Uptake will continue after this, and for complete uptake under all conditions 8 hours may be required.

CROP RESIDUE MANAGEMENT

Withholding periods

Harvest: NOT REQUIRED WHEN USED AS DIRECTED

Grazing/stockfood: DO NOT GRAZE OR CUT FOR STOCKFOOD FOR 4 WEEKS AFTER APPLICATION

SPRAYER CLEAN-UP

The sprayer must be thoroughly decontaminated before being used to spray crops again. Ensure that the following operation is carried out in an area that is clear of waterways, desirable vegetation and tree roots, and preferably in an area where drainings can be contained.

1. Drain sprayer completely and wash out tank, boom and hoses with clean water.
2. Drain again.
3. Fill the tank with clean water and add 300 mL of chlorine bleach (containing 4% chlorine) per 100 L of water with agitation running.
4. Flush some bleach solution through the booms and hoses and allow the remainder to agitate in the tank for 10 minutes.
5. Remove the nozzles and filters and leave them to soak in a bleach solution of 500 mL per 10 L of water while tank-cleaning is in progress.
6. Briefly run the pump at periodic intervals to refresh the chlorine solution in the spray lines.
7. Drain the tank and repeat the procedure of flushing with bleach solution.
8. Flush the tank, boom and hoses with clean water.

GENERAL INSTRUCTIONS

Protection of wildlife, fish, crustaceans and environment

Very toxic to aquatic plants and certain algae. DO NOT contaminate streams, rivers or waterways with this product or used containers.

Protection of crops, native and other non-target plants

DO NOT apply under weather conditions, or from spraying equipment, that may cause spray to drift onto nearby susceptible plants/crops, cropping lands or pastures.

Undersown clovers and medic: DO NOT apply to crops undersown with legumes.

Storage and disposal

Store in the closed, original container in a cool, well-ventilated area. Do not store for prolonged periods in direct sunlight.

Triple or preferably pressure-rinse containers before disposal. Add rinsings to spray tank. Do not dispose of undiluted chemicals on site. If recycling, replace caps and return clean containers to recycler or designated collection point. If not recycling, break, crush, or puncture and bury empty containers in a local authority landfill. If no landfill is available, bury the containers below 500 mm in a disposal pit specifically marked and set up for this purpose clear of waterways, desirable vegetation and tree roots. Empty containers and product or used containers.

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First Aid

If poisoning occurs, contact a doctor or the Poisons Information Centre (telephone 13 11 26).

Material Safety Data Sheet

A Material Safety Data Sheet is available from Bayer CropScience Pty Ltd or at www.bayercropscience.com.au

Safety and disposal

Product will damage the eyes and will irritate the skin. Avoid contact with eyes and skin. If the product gets into eyes, wash it out immediately with water. When opening the container and preparing spray, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and a washable hat, elbow-length PVC gloves and goggles. Wash hands after use. After each day’s use, wash gloves, goggles and contaminated clothing.
The S.T.A.R. program is a simple set of guidelines designed to optimise herbicide results, and to minimise failures. The basic principles apply to all herbicides. While it is impossible in any dynamic and changing biological system to guarantee anything, following the S.T.A.R. program can reduce the risk of herbicide failure. The program’s aim is to promote understanding and management of the four major factors which influence herbicide effectiveness.

**STRESS**

STRESS CAN LOWER A HERBICIDE’S EFFECTIVENESS AND INCREASE CROP EFFECTS

Before using chemicals, ask:
- Is the soil waterlogged?
- When did it last rain?
- Are there insect pests present?
- Have there been frosts?
- Are nutrients sufficient?

**TIMING**

EARLY SPRAYING RETURNS GREATER YIELDS

Spraying at the optimum time:
- Gives greater effectiveness
- Minimises weed competition
- Maximises yield
- Helps achieve better spray penetration and coverage

**APPLICATION**

CORRECT APPLICATION ENSURES OPTIMUM RESULTS

Aim for maximum coverage:
- Check and clean equipment
- Change nozzles regularly
- Follow directions on water volume, and spraying speed
- Spray when weeds are young
- Don’t mix products which are not recommended

**RATE**

CUTTING RATES DOES NOT SAVE MONEY

Using recommended rates:
- Gives maximum effectiveness and consistency
- Increases the speed of weed control
- Maximises yield response
- Helps overcome possible failures caused by unknown stress, timing or application problems
For more information on using Hussar in your crop, contact your local broadacre specialist:

**Western Australia**

Lisa Blacklow  Broadacre Extension Manager  
PERTH WA 0429 055 154  

Peter Burchell  Area Manager  
GERALDTON WA 0427 117 001  

Glen Bergersen  Area Manager  
ALBANY WA 0427 115 007  

Jeff Lander  Area Manager  
ESPERANCE WA 0400 992 555  

Rachel Nightingale  Area Manager  
WYALKATCHEM WA 0427 533 842  

Craig White  Area Manager  
MERREDIN WA 0427 339 470

**New South Wales**

Brenden Green  Area Manager  
COWRA NSW 0427 032 028  

Craigie Lang  Broadacre Support Manager  
TAMWORTH NSW 0409 870 663  

Robert Griffith  Broadacre Extension Manager  
ORANGE NSW 0428 694 628  

Kevin Sternberg  Area Manager  
GRIFFITH NSW 0428 657 781  

Hugo Graesser  Area Manager  
DUBBO NSW 0419 585 731  

Jason Tighe  Area Manager  
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Georgina Allen  Area Manager  
ECHUCA Vic 0428 262 556  

Justin Whittakers  Area Manager  
DENILIQUIN Vic 0429 802 664  

Geoff Berry  Area Manager  
HORSHAM Vic 0400 666 802  

Alistair Crawford  Broadacre Extension Manager  
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**Queensland**

Richard Daniel  Broadacre Extension Manager  
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**South Australia**

Graham Hatcher  Area Manager  
WILLASTON SA 0419 280 143  

Kelly Burke  Broadacre Extension Manager/ Pasture Specialist  
NARACOORTE SA 0417 228 969