**Public Release Summary**
**on**

# Evaluation of the new active

# PROSULFOCARB

# in the product

# BOXER GOLD HERBICIDE

**Australian Pesticides and Veterinary Medicines Authority**

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# FOREWORD

The Australian Pesticides and Veterinary Medicines Authority (APVMA) is an independent statutory authority with responsibility for assessing and approving agricultural and veterinary chemical products prior to their sale and use in Australia.

In undertaking this task, the APVMA works in close cooperation with advisory agencies, including the Department of Health and Ageing (Office of Chemical Safety), Department of Environment (Risk Assessment and Policy Section) and State departments of agriculture and environment.

The APVMA has a policy of encouraging openness and transparency in its activities and of seeking community involvement in decision making. Part of that process is the publication of public release summaries for all products containing new active ingredients and for all proposed extensions of use for existing products.

The information and technical data required by the APVMA to assess the safety of new chemical products and the methods of assessment must be undertaken according to accepted scientific principles. Details are outlined in the APVMA's Manual of Requirements and Guidelines - *The Manual of Requirements and Guidelines - MORAG for Agricultural and Veterinary Chemicals [Ag MORAG & Vet MORAG]*.

This Public Release Summary is intended as a brief overview of the assessment that has been completed by the APVMA and its advisory agencies. It has been deliberately presented in a manner that is likely to be informative to the widest possible audience thereby encouraging public comment.

More detailed technical assessment reports on all aspects of the evaluation of this chemical can be obtained by completing the order form in the back of this publication and submitting with payment to the APVMA. Alternatively, the reports can be viewed at the APVMA Library, 18 Wormald Street, Symonston, ACT 2609.

The APVMA welcomes comment on the usefulness of this publication and suggestions for further improvement. Comments should be submitted to the Pesticides Program Manager, Australian Pesticides and Veterinary Medicines Authority, PO Box E240, Kingston ACT 2604.

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# LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| **AC** | active constituent |
| **ACR** | Acute to chronic ratio |
| **ADI** | Acceptable Daily Intake (for humans) |
| **AHMAC** | Australian Health Ministers Advisory Council |
| **ai** | active ingredient |
| **ARfD** | Acute Reference Dose (for humans) |
| **BBA** | Biologische Bundesanalstalt fur Land – und forstwirschaft |
| **bw** | bodyweight |
| **CRP** | Chemistry and Residues Program |
| **d** | day |
| **DAT** | Days After Treatment |
| **DM** | Dry Matter |
| $DT_{50}$ | Time taken for 50% of the concentration to dissipate |
| $DT_{90}$ | Time taken for 90% of the concentration to dissipate |
| $E_bC_{50}$ | concentration at which the biomass of 50% of the test population is impacted |
| $EC_{50}$ | concentration at which 50% of the test population are immobilised |
| **EC** | Emulsifiable Concentrate |
| **EEC** | Estimated Environmental Concentration |
| $E_rC_{50}$ | concentration at which the rate of growth of 50% of the test population is impacted |
| **ESI** | Export Slaughter Interval |
| **EUP** | End Use Product |
| **FAO** | Food and Agriculture Organisation of the United Nations |
| **Fo** | original parent generation |
| **FW** | Fresh Weight |
| **g** | gram |
| **GAP** | Good Agricultural Practice |
| **GC/MS** | gas chromatography/mass spectroscopy |
| **GCP** | Good Clinical Practice |
| **GLP** | Good Laboratory Practice |
| **GVP** | Good Veterinary Practice |
| **h** | hour |
| **ha** | hectare |
| **Hct** | Heamatocrit |
| **HDPE** | High-density polyethylene |
| **Hg** | Haemoglobin |
| **HPLC** | High Pressure Liquid Chromatography *or* High Performance Liquid Chromatography |
| **HPLC-UV** | High Performance Liquid Chromatography with Ultra-Violet Detector |
| **HR** | Highest Residue |
| **id** | intradermal |
| **im** | intramuscular |
| **ip** | intraperitoneal |
| **IPM** | Integrated Pest Management |
| **iv** | intravenous |
| **in vitro** | outside the living body and in an artificial environment |
| **in vivo** | inside the living body of a plant or animal |
| **JMPR** | Joint FAO/WHO Meeting on Pesticide Residues |
| **kg** | kilogram |
| $K_{oc}$ | Organic carbon partitioning coefficient |
| **L** | Litre |
| $LC_{50}$ | concentration that kills 50% of the test population of organisms |
| $LD_{50}$ | dosage of chemical that kills 50% of the test population of organisms |
| **LC-MS/MS** | liquid chromatography, mass spectroscopy |
| **LOEC** | Lowest Observable Effect Concentration |
| **LOEL** | Lowest Observable Effect Level |

| | |
|---|---|
| **LOD** | Limit of Detection – level at which residues can be detected |
| **LOQ** | Limit of Quantitation – level at which residues can be quantified |
| **mg** | milligram |
| **mL** | millilitre |
| **MRL** | Maximum Residue Limit |
| **MSDS** | Material Safety Data Sheet |
| **MSMS** | mass spectroscopy/mass spectroscopy |
| **NOAEC** | No Observable Adverse Effect Concentration |
| **NDPSC** | National Drugs and Poisons Schedule Committee |
| **NEDI** | National Estimated Daily Intake |
| **NESTI** | National Estimated Short Term Intake |
| **ng** | nanogram |
| **NHMRC** | National Health and Medical Research Council |
| **NOEC/NOEL** | No Observable Effect Concentration/Level |
| **OC** | Organic Carbon |
| **OM** | Organic Matter |
| **PHED** | Pesticide Handlers Exposure Database |
| **PHI** | Pre-harvest interval |
| **po** | oral |
| **POEM** | Predictive Operator Exposure Model (UK) |
| **ppb** | parts per billion |
| **PPE** | Personal Protective Equipment |
| **ppm** | parts per million |
| **Q-value** | Quotient-value |
| **RBC** | Red Blood Cell Count |
| **RP-HPLC** | Reverse Phase High Performance Liquid Chromatography |
| **s** | second |
| **sc** | subcutaneous |
| **SC** | Suspension Concentrate |
| **STMR** | Supervised Trials Median Residue |
| **SUSDP** | Standard for the Uniform Scheduling of Drugs and Poisons |
| **TGA** | Therapeutic Goods Administration |
| **TRR** | Total Radioactive Residues |
| **T-Value** | A value used to determine the First Aid Instructions for chemical products that contain two or more poisons |
| **μg** | microgram |
| **vmd** | volume median diameter |
| **WG** | Water Dispersible Granule |
| **WHO** | World Health Organisation |
| **WHP** | Withholding Period |

# INTRODUCTION

This publication provides a summary of the data reviewed and an outline of the regulatory considerations for the proposed registration of Boxer Gold Herbicide, which contains the new active constituent, prosulfocarb and an existing active constituent S metolachlor. The product is proposed to be used for control of annual rye grass and toad rush in wheat and barley.

Responses to this Public Release Summary will be considered prior to registration of the product. They will be taken into account by the APVMA in deciding whether the product should be registered and in determining appropriate conditions of registration and product labelling.

Copies of full technical evaluation reports on prosufocarb, covering toxicology, occupational health and safety aspects, residues in food and environmental aspects are available from the APVMA on request (see order form on last page). They can also be viewed at the APVMA Library, 18 Wormald Street, Symonston, ACT 2609.

Written comments should be received by the APVMA by 17 January 2007. They should be addressed to:

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## Applicant

Syngenta Crop Protection Pty Ltd

## Product Details

It is proposed to register Boxer Gold Herbicide, containing prosulfocarb at 800 g/L and 120 g/L S–metolachlor as an emulsifiable concentrate formulation. Boxer Gold Herbicide will be manufactured locally and packaged in high-density polyethylene (HDPE) containers.

Prosulfocarb is a S-benzyl thiocarbamate herbicide, which is absorbed by the leaves and roots, and acts by inhibiting lipid synthesis in the meristematic region. It causes dark greening, twisting, inhibition of shoots and roots, and a failure of leaf emergence from coleoptiles. S-metolachlor is registered for use in Australia for the suppression of Annual Ryegrass and control of Toad Rush in barley and wheat (as Dual Gold Herbicide).

The proposed use is as a selective herbicide to control annual ryegrass and toad rush in barley and wheat.

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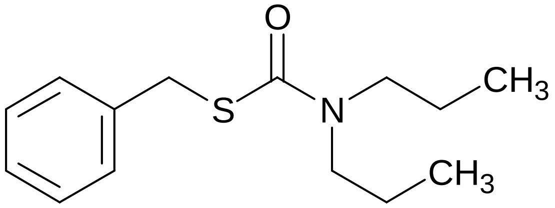
# CHEMISTRY AND MANUFACTURE

## Manufacturing Site

The active constituent Prosulfocarb is manufactured by Ihara Chemical Industry Co Limited at Shizuoka Factory, 1800 Nkanogo, Fudjikawa-cho, Ihara-gun, Shizouoka, Japan and is approved by the APVMA (Approval number : 60358)

## Chemical Characteristics of the Active Constituent

| | |
|---|---|
| Common Name: | Prosulfocarb |
| IUPAC Name: | *S*-Benzyl dipropylthiocarbamate |
| CA Name: | *S*-(Phenylmethyl) dipropylcarbamothioate |
| Manufacturer's Codes: | ICI 574 and SC-0574 |
| CAS Number: | 52888-80-9 |
| Minimum Purity: | 970 g/kg |
| Molecular Formula: | $C_{14}H_{21}NOS$ |
| Molecular Weight: | 251.4 gmol$^{-1}$ |
| Structure: |  |
| Chemical Family: | Thiocarbamate |
| Mode of Action: | Inhibition of lipid synthesis in the meristematic region |

## Physical and Chemical Properties of Pure Active Constituent and Technical Material

| | |
|---|---|
| Melting Point | <20 °C |
| Boiling Point | 341 °C (pure) 338 °C (tech.) |
| Relative density | 1.04 g/cm$^3$ @ 20.5 °C (tech) |
| Vapour pressure | $7.9 \times 10^{-7}$ kPa @ 20 °C (pure) |
| Vapour density | 46 μm/m3 @ 25 °C (pure) |
| Viscosity | 16.57 cS/sec @ 25 °C (tech) |
| Surface tension | 60.9 mN/m @ 25 °C (tech) |
| Physical State, Colour | Pale Straw liquid at 20.5 °C |
| Odour | Strong, sulphurous, with slight smokey resemblance (tech.) |
| Solubility in water | 13 mg/L @ 20 °C |
| pH | 5.52 (pure) 6.82 (tech - 5% solution in acetone:water 1:1) |
| IR spectroscopy | 1646 cm$^{-1}$ (C=O stretch) |
| $^1$H NMR | δ 0.89 (6H, 2 x $CH_3$), 1.61 (4H, 2 x C*H*$_2$), 3.26 (4H, 2 x C*H*$_2$), 4.15 (2H, SC*H*$_2$), 7.21-7.36 (5H, Ar) |
| $^{13}$C NMR | δ 11.2$^{\#}$, 21.1, 21.6, 36.7, 49.2, 49.8, 127.8, |

| | |
|---|---|
| | 128.6, 128.9, 136.3, 167.3 (# coincident Methyls) |
| Solubility in Organic solvents (g/L at 20 °C) | n-heptane Miscible<br>Xylene Miscible<br>1-octanol Miscible<br>Chlorobenzene Miscible<br>Kerosene Miscible<br>Ethanol Miscible<br>Acetone Miscible<br>1,2-Dichloroethane Miscible<br>Methanol Miscible |
| Partition co-efficient n-octanol/water | 4.48 (pure) |
| Henrys Law constant | $1.5 \text{ x}10^{-7}$ atm $m^3$ $mol^{-1}$ @ 20 °C (pure) |
| Hydrolysis rate | No significant hydrolytic degradation at pH 5, 7, and 9 and 25°C and 40 °C (tech) |
| Photolysis | Half life of 25.5 days at pH 7 and 25 °C (tech) |
| Dissociation constant | <0 (pure) |
| Flammability | Not predicted to be flammable (tech) |
| Auto-ignition | 358 ±0.5 °C (tech) |
| Flash point | >151 ±2 °C (tech) |
| Explosive properties | Not predicted to be explosive (tech) |
| Surface tension | 60.9 mN/m @ 25 °C (tech) |
| Oxidising properties | Not predicted to be oxidising (tech) |
| Corrosion Characteristics | No measurable weight loss or gain following contact for 21 days @ 50 °C with Aluminium, Carbon steel, Stainless steel 304 and 316 (tech) |
| Stability | Thermally stable for 2 years under ambient conditions when packaged in 200l stainless steel drums or 24,000 L stainless steel tanks (tech) |
| Dangerous Goods Classification | Not classified as a dangerous good (tech) |

## PRODUCT

| | |
|---|---|
| Distinguishing name: | **Boxer Gold Herbicide** |
| Formulation type: | Emulsifiable Concentrate (EC) |
| Active constituent[s] concentration: | Prosulfocarb (800 g/L)<br>*S*-metolachlor (125 g/L) |

### Physical and Chemical Properties of the Product

| | |
|---|---|
| Physical state: | Liquid |
| Colour: | Slightly Yellowish |
| Odour: | Musty |
| Density or specific gravity: | 1.05 |
| pH (1% solution): | 6.4 |
| Viscosity: | 32.1 mPa.s @ 20 °C |
| Flash point: | 85 ±2 °C |

| | |
|---|---|
| Autoignition: | 365 ±10 °C |
| Explosivity: | Not explosive |
| Oxidising properties: | Not oxidising |
| Corrosivity | Not corrosive to tin, plate, galvanised sheet metal, sheet steel or stainless steel after 7 days @ 54°C |
| Surface tension | 29.9 mN/m - 8.3% aqueous solution<br>30.3 mN/m - 1.5% aqueous solution<br>37 Mn/M - 0.1% aqueous solution |
| Storage stability: | Stability data provided by the applicant indicates that the product is expected to remain within specification for at least 2 years when stored under normal conditions in HDPE containers. |
| Low temperature stability | Minor separation of suspended material observed, but easily resuspended |

## Recommendation

Based on a review of the chemistry and manufacturing details provided by the applicant, registration of Boxer Gold Herbicide is supported.

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# TOXICOLOGICAL ASSESSMENT

## Evaluation of Toxicology

The toxicological database for prosulfocarb, which consists primarily of toxicity tests conducted using animals, is quite extensive. In interpreting the data, it should be noted that toxicity tests generally use doses that are high compared with likely human exposures. The use of high doses increases the likelihood that potentially significant toxic effects will be identified. Findings of adverse effects in any one species do not necessarily indicate such effects might be generated in humans. From a conservative risk assessment perspective however, adverse findings in animal species are assumed to represent potential effects in humans, unless convincing evidence of species specificity is available. Where possible, considerations of the species specific mechanisms of adverse reactions weigh heavily in the extrapolation of animal data to likely human hazard. Equally, consideration of the risks to human health must take into account the likely human exposure levels compared with those, usually many times higher, which produce effects in animal studies. Toxicity tests should also indicate dose levels at which the specific toxic effects are unlikely to occur. Such dose levels as the No-Observable-Effect-Level (NOEL) are used to develop acceptable limits for dietary or other intakes (ADI and ARfD) at which no adverse health effects in humans would be expected.

## Toxicokinetics and Metabolism

In rats, prosulforcarb is extensively absorbed (approx. 70-80%) and almost completely excreted via urine by 48 h after dosing. Metabolism is extensive and produced >24 polar metabolites, with almost a quarter of the total being hippuric acid. Accumulation of the compound or metabolites in organs or tissues is negligible (0.13-0.18 µg/g in kidneys being the highest). The metabolic pathway of the test compound is considered similar to a pathway for the analogous compound benthiocarb established in mice.

Prosulfocarb was absorbed very slowly through human epidermis (mean absorption rates over a 1-10 h period were 1.12 ± 0.105 $\mu g/cm^2/h$ for the neat formulation and 0.129 ± 0.037 $\mu g/cm^2/h$ for the 0.16% solution), compared to glycol ethers, however, the percentage of absorption cannot be estimated based on the available data.

## Acute Studies

Prosulfocarb has low acute oral toxicity in rats ($LD_{50}$ = 1820 mg/kg bw in males and 1958 mg/kg bw in females) and mice ($LD_{50}$ = 3658 mg/kg bw). It has low acute dermal toxicity in rabbits ($LD_{50}$ > 2000 mg/kg bw, no deaths) and low acute inhalation toxicity in rats ($LC_{50}$ > 4720 $mg/m^3$, no deaths, whole body exposure). It is not a skin and eye irritant in rabbits, but was a skin sensitiser in the mouse LLNA.

Boxer Gold Herbicide has low acute oral and dermal toxicity in rats, and is a moderate skin and eye irritant in rabbits, but not a skin sensitiser in guinea pigs. It is likely to have low inhalation toxicity.

## Short-Term Studies

In a 6-week dietary range finding study, mice received prosulfocarb at 0, 100, 300, 600, 1200, 2400, 4800 or 9600 ppm (0, 15, 43, 84, 177, 371, 666 or 1388 mg/kg bw/d in males and 0, 20, 54, 111, 226, 512, 1153 or 1887 mg/kg bw/d in females). The study showed hepatic lesions including mild to moderately severe hepatocellular and nuclear hypertrophy and cytoplasmic eosinophilia at 2400 ppm and above. Histological effects on the liver diminished with decreasing dose to an approximate threshold for mild effects at 2400 ppm.

In a 14-day dose range finding study, rats received prosulfocarb at 0, 40, 200 or 400 mg/kg bw/d in corn oil (likely to be via gavage). A dose level of 100 mg/kg bw/d was introduced on day 8 of the study, as the animals in the 400 mg/kg bw/d dose group showed clinical signs. Body weights in males dosed at 200 or 400 mg/kg bw/d were markedly lower than controls on day 15. Brain cholinesterase activity in males at 400 mg/kg bw/d was significantly lower than in the control animals, but there were no effects on females at this dose level or in either sex at 40 or 200 mg/kg bw/d. Since it is biologically implausible to have cholinesterase inhibition in the brain but not in the blood, the effect on brain cholinesterase activity in males at 400 mg/kg bw/d was not considered to be treatment related. No treatment-related effects were observed at 200 mg/kg bw/day.

Rats were dosed with prosulfocarb at 0, 4, 40 or 400 (or 200) mg/kg bw/d in corn oil, daily by oral gavage for 14 days and followed by a 14-d recovery period. Urinary incontinence was seen in animals dosed at 200 mg/kg bw/d only, but salivation was observed in both sexes at all dose levels. Cholinesterase inhibition was confined to females at 200 mg/kg bw/d and was absent at the end of the recovery period. There were no changes in blood and brain cholinesterase activities. No NOEL was established due to significant body weight reductions in male rats at 4 mg/kg bw/d and above.

In a 4-week range finding study, rats were dosed with prosulfocarb at 0, 300, 600, 1200, 2400, 4800 or 9600 ppm daily in the diet for 4 weeks. Three males and one female at 9600 ppm died during the first week of dosing. The remaining animals in the group were sacrificed at the end of the first week due to their debilitated condition. There was a dose-related reduction in food consumption and body weight gain during the first study week.

In a 4-week study, dogs received prosulfocarb at 0, 80, 120 or 200 mg/kg bw/d in gelatine capsules. There were significant body weight gain reductions at 200 mg/kg bw/d. Dogs also had mild liver effects (enlargement and increase alkaline phosphatase activity) at 80 and 120 mg/kg bw/d, but there were no histopathological changes. Since no histopathology was associated with the liver enlargement and the increase in alkaline phosphatase activity was small, the NOEL was 80 mg/kg bw/d based on bodyweight loss at 200 mg/kg bw/d.

Rats were dosed with prosulfocarb at 0, 25, 140, 800 or 4500 ppm (0, 1, 9, 47 or 282 mg/kg bw/d in males and 0, 2, 10, 52 or 305 mg/kg bw/d in females) daily in the diet for 3 months. Two females and one male at 4500 ppm died at the end of the first week. Reduced body weight gain and food consumption were observed in both sexes at doses 140 ppm and above. The primary histopathological changes in the liver consisted of focal liver cell necrosis, hepatocellular hypertrophy and cytoplasmic eosinophilia at 4500 ppm. Renal lesions were confined to 800 and 4500 ppm males. Based on reduced body weight gain in both sexes at 140 ppm and above, a NOEL of 25 ppm (1 mg/kg bw/d) was established.

Dogs were dosed with prosulfocarb at 0, 10, 30, 80 or 200 mg/kg bw/d in capsules, once daily for 3 months. There were no mortalities. Treatment related reductions in erythrocyte counts, hemoglobin concentration and hematocrit, pallor and salivation were observed at 200 mg/kg bw/d. In males at 80 mg/kg bw/d and above and females at 200 mg/kg bw/d, bodyweights at week 13 were decreased by more than 10% relative to controls. Increased absolute liver weights were seen in males at 200 mg/kg bw/d and in females at 30 mg/kg bw/d and above. Based on increased liver weight with concomitant hepatocellular hypertrophy and bile stasis at 80 mg/kg bw/d and above, the NOEL was 30 mg/kg bw/d.

## Long-Term Studies

Mice received prosulfocarb in the diet for 18 months at 0, 50, 600 or 2400 ppm (0, 5.7, 67 or 269 mg/kg bw/d in males and 0, 7.2, 85 or 350 mg/kg bw/d in females). Animals at 2400 ppm had lower body weight gains during the first 12 months. There were no treatment-related clinical signs or oncogenic effects, haematological effects, and gross necropsy findings. In females, the incidences of pulmonary adenomas were insignificantly increased in comparison with those of the control. The combined tumours also showed a statistically insignificant positive trend when compared to the concurrent controls. Male mice did not show a trend or dose-related incidence in lung tumours. Comparing with historical incidences, background tumour in female mice of this study was considered to be unrelated to treatment. The NOEL was 2400 ppm (269 mg/kg bw/d).

Rats received prosulfocarb for 2 years in the diet at 0, 10, 45, 400 or 1000 ppm (~ 0, 0.4, 1.9, 16.9 or 40 mg/kg bw/d). Body weight gain was reduced in both sexes at 1000 ppm during the first 12 months. Statistically significant decreases in white blood cell counts were observed at 23 months in females at 400 ppm. Treatment with the test substance did not produce a tumorigenic effect. A small number of pancreatic cell tumours were seen in treated females, but not in the control group. This effect was not considered to be treatment related because of the high incidence of this lesion in ageing rats. Hepatocellular adenomas were also slightly increased among females. There were no treatment-related gross necropsy findings. The NOEL was 1.9 mg/kg bw/d (45 ppm) based on body weight gain losses and, decreased white blood cell counts in females at 400 ppm.

## Reproduction and Developmental Studies

In a two-generation reproductive study, there were no reproductive system changes or fertility effects in rats receiving prosulfocarb up to doses of 50 mg/kg bw/d (1000 ppm) in the diet. There were significantly reduced body weights throughout the growth periods in both sexes at 100 ppm and above. Statistically significant reduced pup weights were observed at 1000 ppm, but due to reduced body weights in parental animals. Reproductive indices, litter size or pup survival were not affected. The NOEL for systemic effects was 10 ppm (0.5 mg/kg bw/d) based on reduced body weight gain in males at 100 ppm. The NOEL for reproductive effects was 100 ppm (5 mg/kg bw/d), based on decreased pup weight at 1000 ppm.

There were two rat and two rabbit development studies, where prosulfocarb was administered by oral gavage. In a range finding teratology study, rats were dosed with prosulfocarb at 0, 62.5, 125, 250 or 500 mg/kg bw/d for 13 consecutive days (gestation days 8 to 20). No treatment-related deaths occurred at any dose level. Maternal body weight was reduced from gravid day 9 to 20 and on postpartum day 0 at all dose levels. No external teratogenic effects were observed. Embryotoxicity was noted at the highest dose level. In the other study, rats were dosed with prosulfocarb at 0, 10, 50 or 250 mg/kg bw/d for 15 consecutive days (gestation days 6 to 20). There were no maternal deaths. Reductions in body weight gain and food consumption, reductions in fetal body weights and delayed ossification of sternebra and vertebral centra (delayed fetal growth) were observed at 50 mg/kg bw/d and above. No teratogenic effects were apparent at any tested doses. The NOELs for maternal and embryotoxicity were 10 mg/kg bw/d, based on reduced body weight gains and delayed ossification of sternebra and vertebral centra at 50 mg/kg bw/d and above.

In a range finding teratology study in rabbits, animals were dosed with prosulfocarb at 0, 30, 60, 125, 250 or 500 mg/kg bw/d for 13 consecutive days (gestation days 7 to 19). Three compound-related deaths occurred in the highest dose group between gestation days 13 and 22. The remaining two females in the group were aborted and sacrificed. Clinical effects were observed at 500 mg/kg bw/d. There were no treatment-related clinical observations in animals of any other dose group. In the other rabbit study, the animals were dosed with prosulfocarb for 13 consecutive days (gestation days 7 to 19) at 0, 10, 50 or 250 mg/kg bw/d. One animal died and nine animals aborted between gestation day 18 and 29 in the 250 mg/kg bw/d dose group. No teratogenic responses were observed at any of the dose levels tested. The NOEL was 50 mg/kg bw/d based on death of one animal, increased abortion rate and decreased body weight gain seen in animals at 250 mg/kg bw/d.

### Genotoxicity

Prosulfocarb was not mutagenic or clastogenic in a range of *in vitro* and *in vivo* assays and thus is unlikely to be genotoxic *in vivo*.
Considering the results of chronic studies and genotoxicity studies, prosulfocarb was not considered to be carcinogenic.

### Special Studies

Prosulfocarb had no potential to produce acute delayed neurotoxicity in hens. In acute neurotoxicity studies, rats showed reduced motor activity at doses of 200 mg/kg bw/d and above. Although prosulfocarb was administered by gavage, body weight gain was reduced up to 8% compared to controls, in males and females at 850 mg/kg bw.
An *in vitro* study with rat brain homogenate and human recombinant acetylcholinesterase (AChE) suggested that prosulfocarb would have little inhibitory effect on acetylcholinesterase in rats and humans.

## PUBLIC HEALTH STANDARDS

### Poisons Scheduling

The National Drugs and Poisons Schedule Committee (NDPSC) considered the toxicity of the product and its active ingredients and assessed the necessary controls to be implemented under States' poisons regulations to prevent the occurrence of poisoning.
On the basis of its toxicity, the NDPSC has included prosulfocarb in schedule 6 of the Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP). Based on the toxicological profile of the product, the NDPSC decided that the current scheduling of prosulfocarb was appropriate. There are provisions for appropriate warning statements and first-aid directions on the product label.

### NOEL/ADI

The Acceptable Daily Intake is that quantity of an agricultural compound which can safely be consumed on a daily basis for a lifetime and is based on the lowest NOEL obtained in the most sensitive species. This NOEL is then divided by a safety factor which reflects the quality of the toxicological database and takes into account the variability in responses between species and individuals.

The ADI for prosulfocarb was established at 0.02 mg/kg bw/day based on a NOEL of 1.9 mg/kg bw/day in a 2-year rat feeding study and using a 100-fold safety factor in recognition of the extensive toxicological database available for prosulfocarb.

### Acute Reference Dose (ARfD)

The acute reference dose is the maximum quantity of an agricultural or veterinary chemical that can safely be consumed as a single, isolated, event. The ARfD is derived from the lowest single or short term dose which causes no effect in the most sensitive species of experimental animal tested, together with a safety factor which reflects the quality of the toxicological database and takes into account the variability in responses between species and individuals.

The highest acute dose at which no evidence of toxicity was detected in rats was 40 mg/kg bw in an acute neurotoxicity study. The ARfD was established at 0.4 mg/kg bw on the basis of this NOEL and using a 100-fold safety factor.

# RESIDUES ASSESSMENT

## Introduction

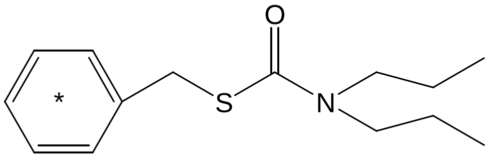
Boxer Gold Herbicide contains the active constituents prosulfocarb and S-metolachlor and is to be used to control a wide range of grass and broad-leaved weeds in wheat and barley. As part of the residues assessment for prosulfocarb, plant and animal metabolism studies, supervised residue trials and trade aspects were considered

S-metolachlor is registered for use in Australia for the suppression of Annual Ryegrass and control of Toad Rush in barley and wheat (as Dual Gold Herbicide). As the application rates in Boxer Gold are similar to those for the use of Dual Gold, further consideration of the residue aspects of S-metolachlor was not required.

## Metabolism

### Plants

The metabolism of prosulfocarb was investigated in barley (2 studies) and wheat, using prosulfocarb labelled with $^{14}C$ in the phenyl ring (Figure 1).



* denotes position of [$^{14}C$] atoms

Figure 1: Position of $^{14}C$ label in prosulfocarb

*Barley (1)*

When phenyl-U-$^{14}C$-prosulfocarb was applied pre-emergence to barley, no prosulfocarb was present in mature straw or grain, but accounted for ~10% of the TRR in forage 7 DAT. Parent is hydrolysed to form the intermediate benzylsulfide, which is then conjugated with a glucose to form 3-benzylsulfanyl-2-(3,4,5-trihydroxy-6-hydroxydro-pyran-2-yloxy)propanoic acid, which is then oxidised to phenylmethanesulfinyl-2-(3,4,5-trihydroxy-6-hydroxymethyl-tetrahydro-pyran-2-yloxy)-propanoic acid. This also accounted for ~10% of the TRR in forage harvested 7 DAT. Parent is also metabolised to benzoic acid which is further conjugated to yield a glucuronide conjugate.

*Barley (2)*

The presence of the parent herbicide and its metabolites was confirmed. The balance of the radioactivity was characterised as polar acids, and their conjugates and other water soluble metabolites. The sulfoxide of prosulfocarb, the despropyl prosulfocarb analogue and benzoic acid were the key intermediates in the proposed metabolic pathway of prosulfocarb in barley (see Figure 2 below).

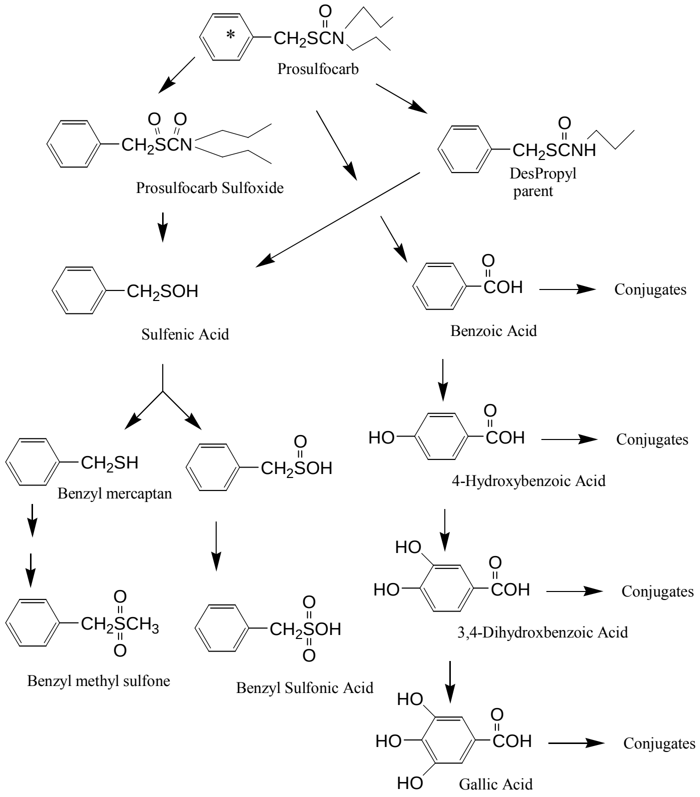


Figure 2. A proposed metabolic pathway for the degradation of [$^{14}$C] prosulfocarb in barley

*Wheat*

Radioactive residues were determined in wheat treated in the field with one application of $^{14}$C-phenyl labelled prosulfocarb between first leaf emergence and second leaf unfolding (Zadok stages 10-12). Grain, stem and straw samples were harvested at maturity.

The results of the study show that there is only a very low level of radioactive residue present in the grain (0.012 mg/kg) at harvest. This residue was extracted and separated into four fractions, all of which were <0.01 mg/kg. In the straw, the radioactive residues were low (0.028-0.036 mg/kg). In one extraction profile, this residue was separated into four fractions, of which the two major fractions were the acetonitrile: water extract (0.014 mg/kg), which were shown to be very polar and appeared to be strongly associated with the plant co-extractives and the post extracted solid (PES) (0.011 mg/kg). None of the radioactivity was identified. Following acid hydrolysis the total residue was split into three fractions. The majority of the residues was contained in the water soluble and the PES fractions.

### *Confined Rotational Crops*

Boxer Gold herbicide is a pre-plant, pre-emergence herbicide for use in cereal crops, it is unlikely that any rotational crop will be planted within 6-9 months of application. It is noted on the label that susceptible crops should not be planted within 9 months of herbicide application. The exception is in a failed crop situation, however if the crop fails early, it is likely that the cereal crop will be re-planted. Further, as shown by the available residues data, detectable residues in cereal forage are not anticipated ~70 days after application; thus indicating detectable resides are unlikely in subsequent crops.

Laboratory aerobic degradation studies of prosulfocarb applied to soil indicated a DT50 (half-life) of 6.3-9.3 days and a DT90 of 21-31 days. For the sulphoxide metabolite, half-lives of

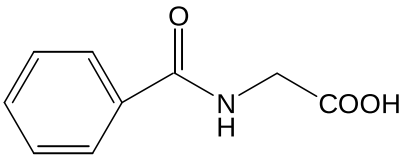
1.6-3.9 days were reported. Under partly anaerobic conditions, prosulfocarb is degraded in soil with an approximate half-life of 35 days. Field dissipation studies show prosulfocarb degraded rapidly with DT50 values in the range of 4-5 days. Photolytic breakdown of prosulfocarb in soils gave a calculated half-life of at least 97 days.

Based on the available information, it is considered unlikely that there will be detectable residues of prosulfocarb in rotational crops.

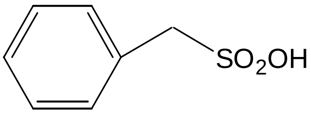
## Animals

Studies were conducted on the metabolism of prosulfocarb in rats. No studies were available in goats or hens.

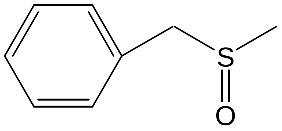
In rats >90% of administered [phenyl-U-$^{14}$C]prosulfocarb was excreted in the urine or faeces within 96 hours. The majority of the excretion, ≥70% was *via* urine. Prosulfocarb was extensively metabolised prior to excretion in the urine. The two major metabolites, hippuric acid and benzylsulfonic acid, accounted for~ 24% and 9% of the urinary TRR, respectively. Another 37% of the TRR was distributed among 22 metabolites that ranged in amount from 0.6% to 4.9% of the TRR. These results were confirmed in a second similar metabolism study.



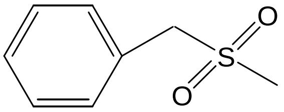
Hippuric Acid



Benzylsulphonic Acid



Benzylmethyl sulphoxide



Benzylmethyl sulphone

Sufficient metabolite identification was accomplished to establish the metabolic pathway. The predominant metabolic pathway begins by oxidation of the α-benzyl carbon with formation of the metabolic intermediates benzaldehyde and benzoic acid. Glycine conjugation results in the formation of hippuric acid. The other pathway is initiated by sulfoxidation of the parent compound leading to the metabolic intermediates benzylsulfenic acid and benzylsulfinic acid. A final oxidation results in formation of benzylsulfonic acid. A minor pathway of the sulfoxidation route results in the formation of benzylmethyl sulfoxide and benzylmethyl sulfone.

## Analytical methods

*Commodities of plant origin*

Prosulfocarb residues in crop samples were extracted with acetonitrile, then after centrifugation, aliquots were diluted with ultra-pure water. A polymer solid phase extraction (SPE) procedure then enabled further clean-up. HPLC with triple quadruple mass spectrometric detection gave the LOQ as 0.01 mg/kg. This method (RAM 405/01) was used for the Australian trials. Recoveries were within an acceptable range of 70-110%.

Two methods used for the determination of residues in forage, grain and straw in trials carried out in Italy and Germany and the U.K involved either extraction with acetonitrile, filtration, column chromatography cleanup and final quantitative determination by gas liquid chromatography or extraction with toluene, filtration into sodium sulphate, and finally determination of residues by gas chromatography using a nitrogen phosphorous bead detector.

*Commodities of animal origin*

Prosulfocarb was extracted from animal tissues and milk using acetone/water (2:1). The extract was saturated with sodium chloride and mixed thoroughly. For liquid-liquid partition ethyl acetate/ cyclohexane (1+1) was added and after repeated mixing excess water was separated. The evaporation residue of an aliquot of the organic phase was cleaned up by gel permeation chromatography using ethyl acetate/ cyclohexane as eluant and an automated gel permeation chromatograph. The residue containing fraction was concentrated, and directly analysed by gas chromatography using capillary column (HP-5MS) and mass selective detector (MSD). The LOQ for prosulfocarb was 0.02 mg/kg for all animal commodities. Recoveries were within an acceptable limits of 70-110%.

## Stability of pesticide residues in stored analytical samples

The frozen storage stability of prosulfocarb in cereal grain, straw and forage was determined in a study commenced in the UK in 1992. Wheat grain, forage and straw were fortified with prosulfocarb at 0.01 mg/kg. Samples of straw and forage were analysed after frozen storage for up to 18 months and grain samples for up to 25 months. No significant decreases of prosulfocarb residue levels were observed in grain, straw and forage samples.

## Residue Definition

A residues definition of prosulfocarb was established in relation to a trial permit. As part of this application, additional plant and animal metabolism data were provided, thus it is appropriate to reconsider the residue definition.

When phenyl-U-$^{14}$C-prosulfocarb was applied pre-emergence to barley, no prosulfocarb was present in mature straw or grain, but accounted for ~10% of the TRR in forage 7 DAT. Parent is hydrolysed to form the intermediate benzylsulfide, which is then conjugated with a glucose to form 3-benzylsulfanyl-2-(3,4,5-trihydroxy-6-hydroxydro-pyran-2-yloxy)propanoic acid, which is itself then oxidised to phenylmethanesulfinyl-2-(3,4,5-trihydroxy-6-hydroxymethyl-tetrahydro-pyran-2-yloxy)-propanoic acid, which also accounted for ~10% of the TRR in forage harvested 7 DAT. Parent is also metabolised to benzoic acid which is further conjugated to yield a glucuronide conjugate. At least three other minor transformations yielding several sugar conjugates were proposed. Individually, none of the remaining metabolites which were characterised or identified accounted for more than 10% of the TRR.

In rats >90% of administered [phenyl-U-$^{14}$C] prosulfocarb was excreted in the urine or faeces within 96 hours. The majority of the excretion, ≥70% was *via* urine. Prosulfocarb was extensively metabolised prior to excretion in the urine. The two major metabolites, hippuric acid and benzylsulfonic acid, accounted for~ 24% and 9% of the urinary TRR, respectively. Another 37% of the TRR was distributed among 22 metabolites that ranged in amount from 0.6% to 4.9% of the TRR. These results were confirmed in a second similar metabolism study.

No metabolism studies in poultry or livestock were provided, as it was argued that due to the proposed use pattern of prosulfocarb as a pre-emergence herbicide which does not result in detectable residues in harvested commodities at the proposed WHP, dietary exposure to livestock would be negligible. Consequently, residues of prosulfocarb are not expected to enter the human food chain as a result of the consumption of animal tissues or products such as eggs and milk. For the purpose of this application, the absence of poultry and livestock metabolism is acceptable.

Several methods for the quantitation of residues in plant tissues were provided. A validated method suitable for the quantitation of residues for the purpose of generation of residues data and compliance purposes was used for the determination of residues in the Australian field trials. The limit of quantitation of the method was 0.01 mg/kg.

Residues are not anticipated in animal commodities as a result of the proposed use pattern. However as feeding of grain, forage and fodder is permitted, it is necessary to establish MRLs for these commodities to monitor compliance with good agricultural practice (GAP). A validated analytical method suitable for the determination of residues in animal commodities was provided.

The Office of Chemical Safety report on prosulfocarb identified no metabolites of toxicological significance.

The available metabolism data, analytical methods and toxicological advice support the existing residue definition of prosulfocarb only.

### Residue Trials

Residue data were provided for barley and wheat.

*Australian Trials*

Twelve field trials were conducted across Australia (Western Australia x 3, South Australia x 3, Victoria x 3 and New South Wales x 3) during 2004/05 and 2005/06 in various varieties of wheat and barley (6 in each). A single post sowing pre-emergent soil application of A14429B (a co-formulation of 800g/L prosulfocarb and 120g/L S-metolachlor) was made to all crops. The 2005/06 trials included forage data only. The product was applied at either 2.5 L/ha (2.0 kg prosulfocarb/ha, 1x the maximum proposed use rate) or 5 L/ha (4.0 kg prosulfocarb/ha; 2x the maximum proposed use rate).

Forage samples were collected from the plots 3, 6 and 8 weeks after application (± 3 days). Samples from 10, 12 and 14 weeks were also collected from two trials. Residues in forage from crops treated at 2.0 kg a.i./ha ranged from <0.01 to 0.21 mg/kg on a dry weight basis 8 weeks after application. Residues in forage from crops treated at 4.0 kg a.i./ha ranged from <0.01 to 0.34 mg/kg on a dry weight basis in wheat and barley respectively, eight weeks after application (note where residues were <LOQ on a fresh weight basis, no correction for dry matter was undertaken). In forage samples taken at 10, 12 and 14 weeks after application, residues in samples at both application rates were <LOQ (fresh weight) in all samples.

Residues in grain and straw were determined at harvest (148-188 days after application). Residues in all samples were below the LOQ from all treatment rates.

*European Trials*

An additional 44 European trials in cereal were provided to support the Australian data. Data included 19 trials in barley (including 7 trials early post emergence), 20 in wheat (including 5 trials early post emergence) and 5 in rye. German trials included data for forage at the 3-6 leaf stage and at 150-260 DAT. Italian and German trials included residues data for grain and straw, while those in the UK were grain only. Two different formulation types were used in the trials; an emulsifiable concentrate containing 800g prosulfocarb/L or an oil in water (EW formulation) containing 750g/L prosulfocarb + 15 g/L isoxaben. From a residues perspective, the formulation types are regarded as equivalent, where the application rate is adjusted to account for the concentration of prosulfocarb in the formulation.

The application rate in the trials provided was 3 kg ai/ha to 6.75 kg ai/ha; representing a considerately higher application than that proposed for Australia (1.5-3.4x). It is noted that the proposed use is for barley and wheat only, however rye is in the same crop group. The proposed use is pre-emergent only, however 12 of the trials provided were for early post-emergent use.

Residues in all grain samples at maturity were <LOQ (0.01-0.04 mg/kg) 131-323 DAT in all trials, including the trials where prosulfocarb was applied early post-emergence.

All forage residues were expressed on a wet weight basis. Dry matter contents for samples were not provided. In the ‘early forage’ samples taken at the 3-6 leaf stage, residues were <0.01, 0.03 and 0.19 mg/kg 49-67 DAT in wheat; <0.01, 0.03 and 0.35 mg/kg 45-58 DAT in barley and 0.10 and 0.12 mg/kg 53-75 DAT in rye. All early forage samples were from trials where prosulfocarb was applied pre-emergence. It is likely that the presence of detectable residues in these samples was as a result of the higher application rate. In all remaining samples at 104-266 DAT, with the exception of a single rye sample that contained residues of 0.02 mg/kg at 202 DAT, residues in wheat barley and rye forage were <LOQ (either 0.01 or 0.02 mg/kg).

*MRL recommendation*

The data from the Australian and European trials were considered sufficient to recommend MRLs for wheat and barley grain, forage (green) and fodder at *0.01 mg/kg. A harvest WHP of ‘Not required when used as directed’ is recommended for grain. A 10 week grazing/cutting WHP for stockfeed is also recommended.

### Animal commodity MRLs

Detectable residues are not anticipated in commodities which will be fed to animals, thus detectable residues are not expected in animal commodities. However, as feeding of commodities that have been treated with prosulfocarb is permitted, it is necessary to establish MRLs in animal commodities for the purposes of monitoring compliance with GAP.

A validated analytical method with a LOQ of 0.02 mg/kg has been provided for the detection and quantitation of residues in animal commodities, and is therefore an appropriate level at which to set animal commodity MRLs. Therefore the following animal commodity MRLs are recommended;

Table 1

| Compound | Food | | MRL (mg/kg) |
|---|---|---|---|
| ADD: | | | |
| Prosulfocarb | MO 0105 | Edible Offal (mammalian) | *0.02 |
| | PE 0112 | Eggs | *0.02 |
| | MM0095 | Meat (mammalian) | *0.02 |
| | ML 0106 | Milks | *0.02 |
| | PO 0111 | Poultry, edible offal | *0.02 |
| | PM 0110 | Poultry, meat | *0.02 |

### Estimated dietary intake

The chronic dietary exposure to prosulfocarb is estimated by the National Estimated Daily Intake (NEDI) calculation encompassing all registered/temporary uses of the chemical and the mean daily dietary consumption data derived from the 1995 National Nutrition Survey of Australia. The NEDI calculation is made in accordance with WHO Guidelines[1] and is a conservative estimate of dietary exposure to chemical residues in food. The NEDI for prosulfocarb is equivalent to 1.3% of the ADI.

It is concluded that the chronic dietary exposure of prosulfocarb is acceptable and residues in food will not pose an undue hazard to the safety of people.

The acute dietary exposure is estimated by the National Estimated Short Term Intake (NESTI) calculation. The NESTI calculations are made in accordance with the deterministic method used by the JMPR with 97.5th percentile food consumption data derived from the 1995 National Nutrition Survey of Australia. NESTI calculations are conservative estimates of acute exposure (24 hour period) to chemical residues in food.

It is concluded that the acute dietary exposure of prosulfocarb is acceptable.

### Bioaccumulation potential

The $K_{ow}$ log P = 4.65 (25 ºC), indicating that prosulfocarb is likely to be fat soluble. Prosulfocarb is soluble in water (13.2 mg/L at 20°C), and is miscible with acetone, chlorobenzene, ethanol, xylene, ethyl acetate and kerosene. The rat metabolism data showed that it is almost completely excreted within 96 hours. There was very little transfer of residues into tissues, and at low doses, residues in the muscle and fat were equivalent. The rat metabolism data indicate prosulfocarb is unlikely to preferentially partition into the fat or bioaccumulate.

### Recommendations

The following amendments will be made to the MRL Standard:

Table 1

| Compound | Food | | MRL (mg/kg) |
|---|---|---|---|
| DELETE: | | | |
| Prosulfocarb | GC 0640 | Barley | T*0.01 |
| | GC 0654 | Wheat | T*0.01 |
| | | | |
| ADD: | | | |
| Prosulfocarb | GC 0640 | Barley | *0.01 |
| | MO 0105 | Edible Offal (mammalian) | *0.02 |
| | PE 0112 | Eggs | *0.02 |
| | MM0095 | Meat (mammalian) | *0.02 |
| | ML 0106 | Milks | *0.02 |
| | PO 0111 | Poultry, edible offal | *0.02 |
| | PM 0110 | Poultry, meat | *0.02 |
| | GC 0654 | Wheat | *0.01 |

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[1] Guidelines for predicting dietary intake of pesticide residues, WHO, 1997.

Table 4

| Compound | Animal feed commodity | | MRL (mg/kg) |
|---|---|---|---|
| ADD: | | | |
| Prosulfocarb | | Barley forage, green | *0.01 |
| | AS 0640 | Barley straw and fodder, dry | *0.01 |
| | | Wheat forage, green | *0.01 |
| | AS 0654 | Wheat straw and fodder, dry | *0.01 |

The following withholding periods are required in relation to the above MRLs:

*Barley, Wheat:*
Harvest: NOT REQUIRED WHEN USED AS DIRECTED
Grazing: DO NOT GRAZE OR CUT FOR STOCK FOOD FOR 10 WEEKS AFTER APPLICATION

# ASSESSMENT OF OVERSEAS TRADE ASPECTS OF RESIDUES IN FOOD

## Commodities exported

Wheat and barley are Australia's most important cereal grain export crops. Details of export volumes, values and markets are summarised below.

## Destination and Value of Exports

In terms of monetary value, wheat including flour was valued at $3296 m, second only to beef and veal (valued at $4272 m) as an Australian export item in 2005/06.[2]

**Comparison of Grain Production and Value to Volume Exported and Export Value.**

| Volume and Value of Grain Exports by Commodity | Production | | Exports | |
|---|---|---|---|---|
| | Volume | Value | Volume | Value |
| **Barley** | kt | $m | kt | $m |
| 1999-00 | 5 032 | 865 | 3 832 | 822 |
| 2000-01 | 6 743 | 1 344 | 4 142 | 1 101 |
| 2001-02 | 8 280 | 1 725 | 4 989 | 1 278 |
| 2002-03 | 3 865 | 984 | 3 462 | 954 |
| 2003-04 | 10 382 | 1 750 | 5 308 | 1 239 |
| 2004-05 | 7 740 | 1 233 | 6 499 | 1 274 |
| 2005-06 | 9 869 | 1 905 | 5 315 | 1 108 |
| | | | | |
| **Wheat** | | | | |
| 1999-00 | 24 758 | 195.1 | 17 838 | 205.4 |
| 2000-01 | 22 108 | 232.1 | 16 142 | 267.9 |
| 2001-02 | 24 299 | 261.6 | 16 317 | 277.9 |
| 2002-03 | 10 132 | 265.7 | 9 107 | 283.1 |
| 2003-04 | 26 132 | 215.7 | 17 867 | 231.1 |
| 2004-05 | 21 905 | 197.1 | 14 675 | 213.7 |
| 2005-06 | 25 090 | 227.2 | 15 967 | 221.5 |

**Volume Wheat and Flour Exports by Destination**

| Volume wheat and flour exports by destination | 1999-00 | 2000-01 | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 |
|---|---|---|---|---|---|---|---|
| | kt | kt | kt | kt | kt | kt | kt |
| Africa | | | | | | | |
| Egypt | 1 018 | 957 | 1 680 | 602 | 2 534 | 752 | 1 818 |
| Ethiopia | 10 | 35 | 10 | 24 | 29 | 0 | 8 |
| South Africa | 189 | 141 | 98 | 48 | 247 | 183 | 85 |
| Asia | | | | | | | |
| Bangladesh | 476 | 252 | 133 | 130 | 141 | 162 | 179 |
| China | 136 | 60 | 46 | 38 | 755 | 1 893 | 303 |
| India | 446 | 7 | 0 | 0 | 4 | 0 | 93 |
| Indonesia | 1 868 | 2 192 | 2 097 | 1 686 | 2 647 | 2 720 | 3 016 |
| Japan | 1 189 | 1 161 | 1 195 | 1 134 | 1 250 | 1 171 | 1 106 |
| Korea, Rep. of | 1 148 | 1 139 | 953 | 1 014 | 1 065 | 1 213 | 1 002 |
| Malaysia | 790 | 775 | 682 | 370 | 737 | 888 | 780 |
| Pakistan | 1 286 | 0 | 0 | 9 | 140 | 653 | 146 |
| Singapore | 94 | 98 | 95 | 65 | 48 | 118 | 68 |
| Sri Lanka | 102 | 262 | 209 | 117 | 132 | 66 | 46 |
| Thailand | 296 | 272 | 285 | 291 | 422 | 478 | 545 |
| Middle East | | | | | | | |
| Bahrain | 0 | 44 | 0 | 0 | 6 | 3 | 0 |
| Iran | 1 520 | 2 352 | 2 420 | 1 064 | 0 | 0 | 425 |
| Iraq | 2 265 | 2 587 | 2 245 | 1 037 | 1 111 | 1 550 | 715 |
| Kuwait | 176 | 180 | 230 | 175 | 259 | 305 | 341 |
| Oman | 376 | 136 | 114 | 27 | 91 | 63 | 86 |
| Qatar | 36 | 28 | 0 | 0 | 0 | 0 | 61 |
| United Arab Emirates | 528 | 399 | 226 | 142 | 196 | 241 | 525 |
| Yemen | 588 | 507 | 450 | 412 | 198 | 314 | 499 |
| Oceania | | | | | | | |
| Fiji | 89 | 93 | 102 | 120 | 122 | 134 | 131 |

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[2] ABARE: 2006 Commodities Statistics (2006)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| New Zealand | 159 | 191 | 305 | 308 | 314 | 339 | 313 |
| Papua New Guinea | 148 | 136 | 110 | 130 | 99 | 134 | 155 |
| Total | 17 329 | 16 621 | 16 464 | 10 845 | 15 073 | 15 779 | 15 168 |
| (value, $m) | 3 481 | 4 197 | 4 612 | 3 109 | 3 475 | 3 488 | 3 296 |

## Codex Alimentarius Commission and overseas MRLs

The Codex Alimentarius Commission (Codex) is responsible for establishing Codex Maximum Residue Limits (CXLs) for pesticides. Codex CXLs are primarily intended to facilitate international trade, and accommodate differences in Good Agricultural Practice (GAP) employed by various countries. Some countries may accept Codex CXLs when importing foods. Prosulfocarb has not been considered by Codex.

Prosulfocarb is registered in a number of overseas countries. The table below shows relevant MRLs in those countries. The entries italicised are provisional registrations.

**Prosulfocarb registration in cereals and associated MRLs**

| Country | Registered For Use On | Crop | Prosulfocarb MRL (mg/kg) |
|---|---|---|---|
| Algeria | Cereal group | - | No MRL process |
| Austria | Barley, winter cereal group, winter wheat | Foodstuff | 0.01 |
| Belarus | Winter wheat | Barley, wheat | 0.05 |
| Belgium | Winter barley, winter wheat | Barley, wheat | 0.05 |
| Chile | Barley, wheat | - | No MRL process |
| Croatia | Winter wheat | Barley, wheat | 0.05 |
| Cyprus | Barley, wheat | Barley, wheat | 0.05 |
| Denmark | Winter cereal group | Barley, wheat | 0.05 |
| Estonia | Winter cereal group | Barley, wheat | 0.01 |
| France | Winter barley, winter wheat | Barley grain, wheat grain | 0.2 |
| | | Cereal group straw | 0.05 |
| Germany | Spring barley, winter barley, winter wheat | Other plant product | 0.05 |
| *Great Britain (UK)* | *Winter barley, winter wheat* | *Barley, wheat* | *0.05* |
| *Greece* | *Barley, wheat* | *Wheat* | *0.02* |
| *Italy* | *Barley, wheat* | *Barley, wheat* | *0.05* |
| Latvia | Winter barley, winter wheat | Barley, wheat | 0.05 |
| Lithuania | Winter wheat | Barley, wheat | 0.05 |
| Luxembourg | Spring barley, winter barley, winter wheat | All crops (general treatment) | 0.05 |
| Netherlands | Winter barley, winter wheat | All crops (general treatment) | 0.01 |
| *Portugal* | *Wheat* | *Barley, wheat* | *0.05* |
| Saudi Arabia | Wheat | - | No MRL process |
| Slovenia | Spring barley, winter cereal group | Barley, wheat | 0.05 |
| Spain | Barley, wheat | Barley, wheat | 0.05 |
| Sweden | Winter cereal group | Barley, wheat | 0.05 |
| Switzerland | Winter barley, winter wheat | Barley, wheat | 0.05 |

In the European Union (EU) MRLs are in the process of being changed from individual country entries to EU MRLs. In mid 2008 TMRLs are expected to be set which will become permanent entries in 2009. For wheat and barley the EU MRL has been proposed to be 0.05 mg/kg.

## Potential Risk to Trade

Export of treated produce containing finite (measurable) residues of prosulfocarb may pose a risk to Australian trade in situations where (i) no residue tolerance (import tolerance) is established in the importing country or (ii) where residues in Australian produce are likely to exceed a residue tolerance (import tolerance) established in the importing country.

Harvested commodities relevant to the current application are exported, however detectable residues of prosulfocarb are not anticipated in these commodities, thus it is considered that use of the product is unlikely to unduly prejudice Australia's trade. In addition detectable residues of prosulfocarb are also not expected in poultry or mammalian meat, offal or other animal commodities such as eggs and milk as a result of feeding of commodities that have been treated with prosulfocarb. As such, residues in any commodities exported are expected to comply with the standards of export markets.

Comments are sought on the potential for Boxer Gold Herbicide to unduly prejudice Australian export trade when they are used on wheat and barley to control Annual Ryegrass and Toad Rush in barley and wheat.

# OCCUPATIONAL HEALTH AND SAFETY ASSESSMENT

## Formulation, packaging, transport, storage and retailing

Boxer Gold Herbicide will be formulated in Australia. The product will be packaged in 20 L and 100 L high-density polyethylene (HDPE) drums and in 1000 L HDPE plastic cubes surrounded by an aluminium cage. Formulation workers may be exposed to the active constituents, other ingredients and/or product. In addition, transport and warehouse workers, storepersons, and retailer will handle the packaged product and will be exposed to the product only if packaging is breached.

## Use pattern and exposure profile

Boxer Gold Herbicide is intended for the control of two herbs in barley and wheat, namely, annual ryegrass and toad rush. Boxer Gold Herbicide can be safely used by workers when handled in accordance with the control measures indicated in this assessment.

The maximum application rate is 2.5 L product/ha in a minimum spray volume of 50 L/ha. The product is to be diluted with water before being applied to soil using ground rig (boom sprayer) application equipment during planting of seeds or immediately after planting and before crop and weeds emerge. The product will be applied once per season as a pre-emergent herbicide. Application should be made to a moist seedbed and sufficient rain should occur to thoroughly wet the top 3 to 4 cm of soil within 10 days after spraying. The draft label does not state any withholding period for harvesting when used as directed. However, treated crops are not allowed to be grazed or cut for stock food for 8 weeks after application.

Farmers and contract spray workers will be the main users of the product. These workers may become contaminated with the product/spray during opening of the containers, mixing/loading, application, cleaning up spills, and maintaining equipment. The main routes of exposure to the product/spray will be dermal and inhalation.

No specific post-application occupational activities associated with the use of the product were identified, apart from irrigation. Exposure will be minimal during irrigation and furthermore, irrigation will not be done immediately and will be mainly done within 10 days after spraying.

An operator exposure study was conducted to determine the dermal and inhalation exposure during mixing, loading and application using Boxer 800 EC (an emulsifiable concentrate formulation of 800 g/L prosulfocarb) with vehicle mounted ground boom sprayers in cereals. While the OCS considered that this study was appropriate to be used in the repeat dose risk assessment, it was also aware that it is not possible to separate the exposure into mixing/loading and application because of no separate collections of samples for overalls during mixing/loading and application. To estimate worker exposure to Boxer Gold Herbicide during mixing, loading and applying the product, OCS used the Pesticide Handlers Exposure Database (PHED) Surrogate Exposure Guide. Both the results of the worker exposure study and PHED estimates were relied on for risk management.

## Risks to workers during use and recommended PPEs

The main risks associated with acute exposure to Boxer Gold Herbicide are eye and skin irritation. Risks of irritancy are high for mixer/loaders handling the undiluted product. Risks of irritancy are low for applicators due to the low concentration of the product (max 5%) in the spray solution.
The main effects associated with repeat dose toxicity of prosulfocarb in animals are reduced body weight gain in rats, and increased liver weight in dogs. Based on the use pattern of the product, a NOEL of 1 mg/kg bw/day, from a 3-month rat dietary study, was determined as most representative for use in the calculation of occupational risks. Since the extent of GI tract absorption for prosulfocarb is approximately 70-80%, the NOEL is adjusted to be 0.7 mg/kg bw/day. As an oral NOEL was selected for the risk characterisation, default absorption factors of 10% (dermal) and 100% (inhalational) were utilised in the calculation of internal doses from PHED data.

The OCS utilised the Margin of Exposure (MOE) approach in the calculation of risks to workers exposed to prosulfocarb, where estimated exposures from PHED or determined exposures from an operator exposure study were compared to the NOEL. MOE at and above 100 are considered acceptable risks for workers exposed to Boxer Gold Herbicide. In the repeat dose risk assessment based on PHED, MOE were unacceptable even when workers wear an additional layer of clothing (overalls). However, in the repeat dose risk assessment based on the worker exposure study, MOE were acceptable when workers wear gloves and overalls together during mixing/loading and application.

Based on the risk assessment, cotton overalls, over normal clothing, buttoned to the neck and wrist (or equivalent clothing) and a washable hat and elbow –length chemical resistant gloves, and face shield or goggles should be worn when opening the container and preparing spray. When using the prepared spray, cotton overalls, over normal clothing, buttoned to the neck and wrist and a washable hat and elbow-length chemical resistant gloves should be worn.

## Entry into treated areas

No specific post-application occupational activities associated with the use of the product were identified, apart from irrigation. Therefore, no re-entry interval was established.

## Hazardous classification

Based on available toxicology information, the OCS has classified prosulfocarb as a hazardous substance in accordance with the NOHSC *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 2004) with the following risk phrases:

| | |
|---|---|
| R22 | Harmful if swallowed |
| R43 | May cause sensitisation by skin contact |

Based on the product toxicology information, the OCS classified Boxer Gold Herbicide as a hazardous substance in accordance with ASCC Approved Criteria for Classifying Hazardous Substances (NOHSC, 2004) with the following risk phrase:

| | |
|---|---|
| R38 | Irritating to skin |

# ENVIRONMENTAL ASSESSMENT

## INTRODUCTION

Syngenta has applied for the registration of a new product *Boxer Gold Herbicide,* containing the new active constituent (ac) prosulfocarb 800 g ac/L, and S-metolachlor (120 g ac/L) for use on wheat and barley for the control of annual ryegrass and toad rush. The product will be marketed as an emulsified concentrate formulation with a proposed maximum application rate of 2000 g prosulfocarb/ha and 300 g S-metolachlor/ha. As the proposed maximum application rate (300 g ac/ha) for S-metolachlor is less than the currently registered product *Dual Gold Herbicide* for use on wheat and barley, an environmental assessment was not conducted for S-metolachlor.

## ENVIRONMENTAL CHEMISTRY AND FATE

### Hydrolysis

A study was conducted at pH 5, 7 and 9 at 25 and 40ºC, indicating that no significant hydrolytic degradation of prosulfocarb occurred at the tested conditions. The hydrolysis of radiolabelled prosulfocarb in pH 4, 7 and 9 buffers at 25°C in the dark for up to 30 days was also evaluated. Two minor metabolites were observed at ≤1.0% AR and the parent compound was found to be stable to hydrolysis under these conditions.

### Photolysis

### Aqueous photolysis

US studies indicate that upon photolysis with an artificial light source of both radiolabelled and non-labelled prosulfocarb at pH 7 and 25ºC, photolytic products were identified as dipropylamine, propylamine, benzaldehyde, benzyl alcohol, prosulfocarb sulphoxide and prosulfocarb sulphone. The identified photoproducts gave a recovery of 92.6% for the amine moiety and 64.9% for the benzyl moiety of prosulfocarb and the photolytic half-life of prosulfocarb was determined to be 25.5 days.

A UK study on the aqueous photolysis of radiolabelled prosulfocarb using a Suntest Accelerated Exposure Instrument indicated that there was no significant decline in the concentration of prosulfocarb in sterile buffer at pH 7 after continuous irradiation corresponding to approximately 38 days summer sunlight at latitude 50ºN. No major degradates were detected in either irradiated or dark control test solutions.

However, another UK study was conducted to investigate the photolysis of radiolabelled prosulfocarb in sterile natural water at 25ºC under continuous irradiation using the same source for up to 50 days (equivalent of ca 30 days summer sunlight at latitudes of 30-50ºN and 100 days Tokyo spring sunlight). Four degradates were identified as benzaldehyde (maximum level of 15.2% AR), benzyl alcohol (maximum level of 5.3% AR), benzoic acid (maximum level of 1.9% AR) and benzyl sulphonic acid (maximum level of 3.3% AR). Up to 28.6% AR was evolved as volatile components with benzaldehyde as the predominant component, which was further degraded to a number of minor degradates observed at ≤3.5% AR. The estimated half-life was approximately 30 days of summer sunlight at latitudes of 30-50ºN and 94 days of Tokyo spring sunlight.

### Soil photolysis

The photodegradation of radiolabelled prosulfocarb on soil at an application rate of 4.22 g ac/ha was conducted at 25ºC with continuous irradiation again using the same source up to a maximum of 6 days (equivalent to a maximum of 30 days of summer sunlight at 50ºN). Volatile radioactivity accounted for 9.9% and 3.6% AR in irradiated and non-irradiated soils, respectively. The soil extracts indicated that the only major component was unchanged prosulfocarb in both irradiated and non-irradiated samples. No other degradates were found in any of the dark control samples and there were only 2 minor components in the irradiated samples. One was considered to be benzyl alcohol which reached a mean maximum of 6.9% AR and the second component, which reached a mean maximum concentration of 4.9% AR, was not identified. The photodegradation of prosulfocarb was determined to be degraded slowly with an apparent half life of at least 97 days of summer sunlight at 50ºN.

### Metabolism in Soil and Water

## Aerobic soil metabolism

An aerobic metabolism of $^{14}$C-prosulfocarb in a single soil treated at a rate of 5 mg/kg soil indicated that prosulfocarb was rapidly metabolised between 14 and 59 days and had an estimated half-life of 35 days. After 84 days of incubation none was extractable with water, 48% was lost as $^{14}CO_2$, 27% was bound and only 8% was extractable with acetone. This corresponds to a total of 83% AR, of which 75% was accounted for as $^{14}CO_2$ and bound residues. In comparison, after 96 days incubation in a repeat study 1% of the applied radiolabel was extractable with water, 30% with acetone, 38% had evolved as $^{14}CO_2$ and 27% was bound residues. In this case only 65% of the applied radiolabel was accounted for as $^{14}CO_2$ and bound residue due to a slower rate of $^{14}CO_2$ production. In both studies, the major portion of extractable radiolabel was the parent compound and the major metabolite, prosulfocarb sulphoxide reached a maximum of 6.8% AR at 18 days after incubation. The results indicate prosulfocarb was converted to its sulphoxide form which was then rapidly degraded and mineralised by soil micro-organisms.

The degradation rate of prosulfocarb was investigated in silt loam, sandy clay loam and silty clay loam under aerobic conditions for up to 42 days. Prosulfocarb was applied in the top 5 cm soil layer at an application rate of 4 kg ac/ha. Soil samples were taken on days 0, 3, 7, 10, 14, 21, 28 and 42 and the extracts were subjected to LC/MS analysis. The amount of prosulfocarb decreased rapidly to 14.7, 20.7 and 35.7% after 14 days incubation in the respective soils. After 42 days of incubation, the test substance represented only 1, 1.6 and 4.5% in the respective soils. The DT50s were determined to be 6.3-9.3 days for the soils studied.

The degradation of the metabolite, prosulfocarb sulphoxide was investigated in loam, sandy clay loam and silty clay loam for a period of 120 days. Prosulfocarb sulphoxide degraded rapidly in all soils tested with a DT50 ranging from 1.6-3.9 days. The major product of the degradation was carbon dioxide. No other single product was observed at >6.8% of the applied dose.

## Anaerobic soil metabolism

The anaerobic metabolism of prosulfocarb was performed in soil treated at a rate of 5 mg/kg soil with radiolabelled prosulfocarb over a period of 96 days. Anaerobic conditions were induced by flooding the soil on day 28 (note not demonstrated by redox potential or $O_2$ values). The results indicate that prosulfocarb was rapidly metabolised between 0 and 45 days and had an estimated half-life of 35 days. At 45 days of incubation (17 days after establishing anaerobic conditions), 1% remained in the floodwater, 26.5% was lost as $^{14}CO_2$, 22.3% was bound and 46.1% was extractable with acetone. The major portion of extractable radiolabel was the parent compound and the major metabolite, prosulfocarb sulphoxide. The acetone extracts indicate that prosulfocarb and its metabolite sulphoxide comprised 94% or more of the extracts. The sulphoxide metabolite reached a maximum of 7% AR on day 18 and decreased to 1% thereafter within 60 days. The results indicate that prosulfocarb is converted to its sulphoxide metabolite which is then rapidly degraded and mineralised to carbon dioxide by soil micro-organisms.

### Aerobic aquatic metabolism

The rates of dissipation in water and water/sediment systems were investigated with radiolabelled prosulfocarb which was applied at an application rate 4 kg ac/ha in a 30 cm deep body of water for up to 107 days. The results indicate that the major component present in both systems at the end of the study was prosulfocarb. Degradation of prosulfocarb in both water and sediment was extensive with $CO_2$ the only major degradate detected. No metabolite of prosulfocarb reached significant levels (<1%) in either systems. Only one minor degradate was identified as prosulfocarb sulphoxide on day 107 accounting for <1% AR in either sediment or water. The DT50 values for prosulfocarb were determined to be 0.6-1.5 and 147-381 days for the water and water/sediment, respectively where the significantly longer half-life in sediment may be accounted for by its anaerobic nature.

### Mobility

#### Volatility

Radiolabelled prosulfocarb was applied to the soil and bean leaf surfaces at an application rate of 4 kg ac/ha. 24 hours after application 82% of the applied radioactivity was still present in the soil but only 53.3% was present on the bean leaves. These results indicate that prosulfocarb did not volatilise appreciably from soil surfaces over a 24 h period, but it did volatilise more readily from leaf surfaces.

A study was conducted to determine the type of volatile compounds evolved from soil treated with the metabolite as radiolabelled prosulfocarb sulphoxide at a field application rate of 0.8 kg ac/ha. It was found that mineralisation of the metabolite to $^{14}CO_2$ was very rapid reaching up to 39% AR within 6 days of incubation and up to 56% after 30 days in an open flow-through system. Bound residues were also mineralised with time. No other volatile compounds were observed during the tests.

### Soil adsorption/desorption studies

Adsorption/desorption of radiolabelled prosulfocarb was determined in 3 different soil types (sand, silt loam and clay-clay loam). Analysis of the aqueous phase of the soil/water system after equilibration showed that 63.7-81.6% of the radioactivity present in the water was the parent compound. The Koc values in the range of 1367-2339 indicate that prosulfocarb was strongly adsorbed to soils and the mobility in soils is classified as slight to low.

Adsorption/desorption of prosulfocarb was also studied in 5 different soil types (sandy clay loam, loam, loamy sand, silt loam and sandy loam). The Freundlich adsorption constant K varied between 27 and 56.7. The mean Koc for the 5 soils was 1647 (ranged from 712-2760) and thus prosulfocarb is considered to be strongly adsorbed and of low mobility in soils. The mean Koc for all 5 soils for desorption 1 and 2 were 2124 and 2706, respectively, indicating prosulfocarb desorbs less easily in soils.

The adsorption/desorption properties of radiolabelled prosulfocarb sulphoxide was studied in 3 soils (sandy clay loam, loam and silty clay loam). The Kd values for the adsorption step ranged from 1.23-2.55 with the corresponding Koc ranging from 52-68. The Koc values for the first and second desorption steps ranged from 94-113 and 121-138, respectively. These results indicate that prosulfocarb sulphoxide can be classified as having a high potential for mobility in all 3 soils.

## Soil Column Leaching

A study was conducted to determine the extent of leaching that prosulfocarb and its degradates underwent in 4 soil types (silt loam, loam, sandy loam and sand). Radiolabelled prosulfocarb was incubated in a silt-loam soil to the half-life of the compound (16 days). It was found that 13.7% was evolved as $^{14}CO_2$, 0.21% volatilised, 51.7% and 6.1% were extractable into acetone and water, respectively and 19.7% remained bound to the soil. TLC chromatography of the acetone extract showed that 43.3% of the parent compound remained in the soil after 16 days of incubation and another 5% co-chromatographed with prosulfocarb sulphoxide.

An aliquot of the unextracted aged soil was placed on the top of each of the four 45 X 1 cm soil columns to a depth of 6 cm. After leaching with 50 mL of water, the top 2 soil sections from each column were extracted with acetone/water which was found to contain prosulfocarb and prosulfocarb sulphoxide. The leachate from each column was analysed for any degradates which were characterised as prosulfocarb sulphoxide, benzoic acid, a degradate with similar characteristics as benzoic acid and a minor component of highly polar material. A small quantity of parent compound was identified in the leachate from the silt loam and loam soil columns.

Adsorption coefficients Kd ranging from 0.19-3.56 were calculated, for each column for the radioactivity that leached and for that which remained on the column after leaching, indicating that prosulfocarb and its degradates have a low potential for leaching.

### Field dissipation

Four trials were performed in Germany to study the field soil dissipation of prosulfocarb and its metabolite, prosulfocarb sulphoxide at an application rate of 4 kg ac/ha. Soil samples were collected at intervals up to 347 days after treatment to a depth of 30 cm. The results indicate that prosulfocarb residues declined rapidly with DT50 and DT90 values in the range of 4-5 days and 46-56 days, respectively. No residues were found in any sample taken 188 days after application. Only 0.04 mg/kg of prosulfocarb sulphoxide was detected in the 0-10 cm horizon at 0 time from 1 trial. No residues of either prosulfocarb or its sulphoxide were detected below the top 10 cm horizon. These studies indicate that prosulfocarb is not persistent and not likely to leach to ground water.

### Bioaccumulation in aquatic organisms

Two dynamic 42 day US studies were conducted on the bioconcentration of $^{14}$C-prosulfocarb by rainbow trout at treatment levels of 0.05 and 0.005 mg/L for the 28-day exposure period. Radioanalysis of fillet, whole fish and visceral portions were performed throughout the exposure period.

It was concluded from the uptake and depuration data that $^{14}$C-prosulfocarb reached steady-state plateau by day 14 for the 0.05 mg/L treatment level and by day 3 for the 0.005 mg/L treatment level. The mean measured BCF values for the tissues on day 28 were in the range of 480-1100 and 230-700 for 0.05 mg/L and 0.005 mg/L exposure levels, respectively. Following 14 days of depuration, there was an average clearance of 98-99% of tissue radioactivity at both treatment levels. These data demonstrate that prosulfocarb is rapidly depurated from fish tissue in renewed water and thus is unlikely to bioaccumulate in aquatic organisms.

## ENVIRONMENTAL EFFECTS

### Avian

Prosulfocarb is practically non-toxic to birds, based on 5-day dietary testing in bobwhite quail and mallard ducks ($LC_{50}$ >5620 ppm) and 14-day acute oral testing in bobwhite quail (LD50 >2250 mg/kg). The dietary administration of prosulfocarb on reproduction of the Mallard duck over 20 weeks produced no significant effects on the reproductive capacity of birds at dose levels up to 1000 ppm.

### Aquatic organisms

Acute toxicity studies on rainbow trout, fathead minnow, carp and bluegill sunfish indicate that prosulfocarb is moderately toxic to fish (96 h LC50 between 1.65-6.4 mg ac/L). Its sulphoxide metabolite with a 96 h LC50 = 11.0 mg ac/ha is slightly toxic to rainbow trout. A chronic toxicity study based on mortality and sub-lethal effects gave a 21 days NOEC = 0.31 mg ac/L, indicating a slightly toxic effect to rainbow trout.

Acute toxicity ranged from moderately toxic to highly toxic for prosulfocarb to daphnia, water louse, phantom midge larva, mayfly nymph and amphipod (48 EC50 = 0.51-1.75 mg/L). Prosulfocarb sulphoxide was moderately toxic (48 h EC50 = 4.1 mg ac/L) to daphnia. Two chronic toxicity studies for an exposure period of 21 days indicate that prosulfocarb is moderately toxic (21 days NOEC = 0.045-0.047 mg ac/L) to daphnia. A 25 days chronic study indicates that prosulfocarb is very slightly toxic (NOEC = 1.25 mg ac/L) based on the emergence and development rate of the sediment dwelling larvae of the midge (*Chironomous riparius*).

Aquatic plant toxicity tests with prosulfocarb using algae gave a 96 EbC50 values = 0.09-3.77 mg ac/L and 96 h ErC50 = 0.16-7.48 mg ac/L, showing this herbicide exhibits moderately to highly toxic effects to alga based on ErC50 values. For freshwater diatom and duckweed the toxicity levels of prosulfocarb were determined to be 72 h ErC50 = 0.68 mg ac/L and 14 days ErC50 = 0.85 mg ac/L, respectively, indicative of a high toxicity to these species. The 14 days chronic toxicity for duckweed was determined to be 0.23 mg ac/L. The 96 h ErC50 = 4.75 µg/L for the sulphoxide metabolite indicates a very high toxic effect to green alga.

### Non-target Invertebrates (Terrestrial)

*Bees*
The contact 48 h LD50 in the honey bee were determined in two separate studies to be >80 µg ac /bee and >100 µg formulated product/bee, the highest concentrations tested in the studies. For oral toxicity the 48 h LD50 was determined to be 130.5 µg formulated product/bee. The results indicate that honey bees were not acutely sensitive to applications of prosulfocarb, or to the EC formulated product containing only prosulfocarb.

*Earthworms*
A study performed on the effect of prosulfocarb on earthworms indicate that prosulfocarb is not toxic to earthworms at concentrations <100 mg/kg. The LC50 determined after 7 and 14 days exposure were 184.2 and 143.6 mg/kg soil, respectively. Another study was conducted where the 14 day LC50 for the metabolite prosulfocarb sulphoxide was determined to be 177 mg/kg dry soil and the NOEC was <62.5 mg/kg dry soil. Thus prosulfocarb and prosulfocarb sulphoxide are considered to be slightly toxic to earthworms.

*Beetles*
Two laboratory studies on carabid beetles showed that the LC50 and NOEC for prosulfocarb was determined to be >4 kg ac/ha and 4 kg ac/ha, respectively, for an exposure period of 6 days.

*Predatory mite*
A laboratory test to determine the effect of prosulfocarb on the predatory mite (*Typhlodromus pyri*) was conducted at an application of up to 1,000 g ac/ha for 7 days. The 7 day LC50 was determined to be 524 g ac/ha based on lethal and sub-lethal effects. For the fecundity data, no effect was observed at 320 g ac/ha and thus the NOEC was determined to be 320 g ac/ha.

*Spiders*
Prosulfocarb was applied at an application rate of 4 kg ac/ha to bare soil and to newly emerged winter wheat in an enclosure containing spiders (*Pardosa spp.*). The 14 days semi-field exposure resulted in a maximum of 4% spider mortality. No statistical significant reduction in feeding activity was observed.

Two studies demonstrated that at the application rate of up to 4 kg ac/ha, prosulfocarb was considered to be slightly harmful to lycosid spider according to the IOBC classification where 43-57% mortality were observed over an exposure period of 6 days.

*Aphid parasitoids*
A laboratory study on the effect of prosulfocarb to the cereal aphid parasitoid (*Aphidius rhopalosiphi*) indicates that the 48 h LC50 was determined to be 41.8 g ac/ha. Statistically

significant effects on fecundity following exposure to prosulfocarb were observed at an application rate of 5, 20 and 40 g ac/ha.

A followed up extended laboratory study was performed on the cereal aphid parasitoid (*Aphidius rhopalosiphi*) at an application rate of up to 4 kg ac/ha for 48 h exposure. The 48 h LC50 was determined to be 3081 g ac/ha. Statistically significant effects on fecundity following exposure to prosulfocarb were observed at treatment levels of 500 and 2,400 g ac/ha but none at the 1000 g ac/ha. No fecundity effects >50% were observed in any of the three treatments. It was considered that prosulfocarb is unlikely to cause an adverse effect to aphid parasitoid up to an application rate of 1000 g ac/ha.

### Microorganisms

A study was conducted to investigate the effects of prosulfocarb upon asymbiotic nitrogen fixation activity in sandy loam soil at concentrations of 4 and 40 kg ac/ha. It was concluded that prosulfocarb had no effect upon asymbiotic nitrogen fixation associated with the soil up to an application rate of 40 kg ac/ha.

The effect of prosulfocarb on soil microbes was determined in a separate study by measuring soil respiration, ammonification and nitrification in sandy loam and clay-clay loam soils incubated with 4 or 40 kg ac/ha application rates for an exposure period of 42 days. No significant effects of prosulfocarb on the ammonification and nitrification process were observed up to an application rate of 40 kg ac/ha.

### Phytotoxicity

Two studies on 11-12 species of non-target plants were tested using a single pre-emergent and post-emergent application of prosulfocarb, respectively. Each species was subjected to application rates of up to 10 kg ac/ha and the test duration was 21 days after application. The number of emerged seedlings was observed and the plant height and total shoot weight were determined at test termination. For the pre-emergence study there were no effects on 2 of the 11 species tested at rates up to 10 kg ac/ha. Biomass was the most sensitive endpoint with ER50 ranging from 0.335 to 9.83 kg ac/ha. Tomato was determined to be the most sensitive plant to the effects of prosulfocarb. For post-emergence study the results indicate that 8 of the 12 species had ER50 values above the highest rate tested. Biomass was the most sensitive end-point for 3 species while height was the most sensitive for 1 species. The most sensitive plant was determined to be the oat. These results indicate prosulfocarb is likely to exhibit phytotoxicity towards a large range of non-target plant species, particularly from pre-emergent exposure.

## PREDICTION OF ENVIRONMENTAL RISK

- ### Birds

Exposure at the time of application could occur by birds eating contaminated insects or by direct contact with the spray or indirect contact with treated vegetation. Estimated concentrations resulting in birds' diets exclusively based on such exposure ranged between 78 and 209 mg prosulfocarb/kg feed. These worst case concentrations are well below the 5-day dietary LC50 values for two bird species. Consequently, the proposed use is not likely to present an acute or dietary risk to birds.

- ### Aquatic organisms

Contamination of a shallow (15 cm deep), static waterbody with direct overspray at the maximum application rate of 2000 g prosulfocarb/ha is calculated to give a notional concentration in the water of 1.3 mg ac/L. Based on the relevant ecotoxicity endpoints, acute risks from a direct overspray to sensitive aquatic species tested were unacceptable. With a 10% spray drift, the acute risk of prosulfocarb to daphnia, diatoms and duckweed is mitigable, but it is unacceptable for daphnia from a chronic exposure and for acute toxicity to alga. A further refinement of risk to alga and daphnia from spray drift of prosulfocarb and its sulphoxide metabolite is possible from use of the more realistic Ganzelmeier spray drift values from ground application. This shows that a buffer distance is considered unnecessary based on the likely extent of spray drift for both acute and chronic exposures.

Because prosulfocarb is expected to show low to medium mobility in the environment, there is a potential for prosulfocarb to enter aquatic habitats in water as a result of their presence in the runoff from treated land. A simple modelling of such runoff indicates unacceptable risk to alga and daphnia for acute and chronic exposure, respectively. Mitigation of this risk based on a more realistic runoff scenario and one cycle of adsorption of prosulfocarb to the soil shows that aquatic risk from runoff from the proposed use patterns is expected to be acceptable. Risk to groundwater is not anticipated from the proposed use patterns.

- **Non-target invertebrates and micro-organisms**

The proposed registration of *Boxer Gold Herbicide* at a maximum use rate of 2000 g prosulfocarb/ha use is not expected to present unacceptable risks to bees, beneficial and predatory insects and earthworms, or to have lasting effects on soil respiration and nitrification processes. This is based on studies showing that relevant toxicity endpoints were well below the concentrations tested which showed no adverse effects, or from exposure.

- **Non-target vegetation**

Non-target plants are expected to be adversely affected by spray drift. Based on the most sensitive plant observed (ER50 of 0.335 kg ac/ha for tomato), a risk assessment can be performed on non-target vegetation. The resultant risk quotient indicates an acceptable risk at a downwind buffer distance of 3 metres.

### CONCLUSION

The proposed use of *Boxer Gold Herbicide* is not likely to present either an acute or dietary risk to birds ingesting residues on plants or insects. The risk to terrestrial invertebrates is low. Prosulfocarb has some toxicity to predatory mites and spiders, but it is unlikely to have an adverse effect at the proposed application rates for the control of annual ryegrass and toad rush. While prosulfocarb is highly toxic to the water louse, phantom midge larva, alga, diatoms and duckweed, and moderately toxic to fish, amphipods, mayfly nymphs and daphnia, aquatic risk modelling indicates that a buffer zone is unnecessary under the proposed use pattern as a result of spray drift for both acute and chronic exposure. Assessment for run-off indicates that prosulfocarb is unlikely to pose an environmental risk from the proposed use.

In order to be satisfied that the proposed uses of *Boxer Gold Herbicide* will not lead to an unintended effect that is harmful to animals, plants or the environment at the proposed rate and following good agricultural practice, DEW recommends the draft label's Protection of Wildlife, Fish, Crustaceans and Environment statement be amended to include a statement "Highly toxic to aquatic organisms".

Acceptance of this recommendation allows DEW to recommend that the APVMA be satisfied that the proposed use of *Boxer Gold Herbicide* would not be likely to have an unintended effect that is harmful to animals, plants, things or on the environment.

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# EFFICACY AND SAFETY ASSESSMENT

## Application Purpose and Justification of Use

Boxer Gold Herbicide is essentially a pre-mix of prosulfocarb (80%) and S-metolachlor (12%). This herbicide will provide 2 modes-of-action (MOA), E and K, for the pre-emergent control of annual ryegrass (ARG). These MOAs are currently not widely used to control ARG in Australia.

The past few years has seen a rapid increase in the use of trifluralin in Australia to control ARG as the number of weed populations resistant to Groups A and B has increased. This increased use of trifluralin has seen a concurrent increase in the number of trifluralin (Group D) resistant populations.

Boxer® Gold will have a useful fit in southern Australian farming systems to help manage the increasing numbers of A, B and D resistant ARG populations. The applicant has presented 3 supporting documents on the level of herbicide resistance in ARG across southern Australian farming systems.

A further reference presented the results of 2 preliminary glasshouse trials from Switzerland, conducted in 2004, examining the rate response of Boxer® Gold on ARG. These trials showed that 2760 g ai Boxer Gold gave a good level of control of ARG and that incorporation of the herbicide improved efficacy.

A pot trial was conducted in 2005, investigating the efficacy of Boxer Gold at 4 rates on 22 known populations resistant to Group D. Boxer Gold was effective at controlling all Group D resistant populations.

Twenty two field trials in 2004 and 2005 investigated efficacy of Boxer Gold alone at a range of rates, and Boxer Gold tank-mixed with trifluralin. These were compared with trifluralin and, in some trials, a tank-mix of trifluralin and S-metolachlor. The trials were conducted over a range of soil types and environments ranging from Narrabri, NSW to Green Hills in Western Australia.

Trial design, assessments and statistical analysis were adequate.

Boxer Gold at 2.5 L/ha alone gave equivalent or better control of ARG compared with trifluralin. Higher rates of Boxer Gold alone only gave marginal increases in ARG control. Boxer Gold 1.5 L and trifluralin 1-1.5 L gave equivalent control to Boxer Gold alone at 2.5 L on trifluralin susceptible populations.

Incorporation by sowing (IBS) gave more consistent control compared with post sowing pre-emergent applications (PSPE), unless rain fell within a few days of application.

Crop safety field trials, investigating a range of rates from 1.5 to 5 L/ha Boxer Gold IBS and PSPE, showed that rates ≤ 2.5 L/ha gave only minor herbicide symptoms and some height suppression with no significant reductions in crop number, with no reduction in yield. Boxer Gold at 3.3 and 5 L/ha, particularly when applied IBS, caused significant crop damage which may have led to yield loss.

Weed-free tolerance screens (Refs. 10-16) were conducted in 2005 in Queensland, NSW, Victoria, South Australia and Western Australia. Good levels of crop safety exist at 2.5 and 5 L/ha, however the higher rate may cause some increased phytotoxicity under certain climatic conditions.

The data presented support the label claims. The compatibility list was required to be modified to reflect crop plant-back times and this was done.

## Conclusion

Sufficient statistically analysed data from suitably designed and scientifically conducted trials has been presented to substantiate the claim for use shown on the proposed label. The data demonstrate that the product should be suitable for control of annual rye grass and toad rush in barley and wheat when used in accordance with the proposed label instructions and Good Agricultural Practice (GAP).

# LABELLING REQUIREMENTS

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Label/booklet - Base label

**CAUTION**

**KEEP OUT OF REACH OF CHILDREN**
**READ SAFETY DIRECTIONS BEFORE OPENING OR USING**

## STORAGE AND DISPOSAL

Store in the closed, original container in a cool, well ventilated area. DO NOT store for prolonged periods in direct sunlight.

**Refillable containers**

Empty contents fully into application equipment. Close all valves and return to (point of supply/ designated collection point/ other specific collection details) for refill or storage.

**Other containers**

Triple or preferably pressure rinse containers before disposal. Add rinsings to spray tank. DO NOT dispose of undiluted chemicals on site. If recycling, replace cap 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 should not be burnt.

## SAFETY DIRECTIONS

**Will irritate the eyes and skin. Avoid contact with eyes and skin. When opening the container and preparing spray wear:**

- **cotton overalls, over normal clothing, buttoned to the neck and wrist**
- **washable hat**
- **elbow-length chemical resistant gloves**
- **face shield or goggles**

**When using the prepared spray wear:**

- **cotton overalls, over normal clothing, buttoned to the neck and wrist**
- **washable hat**
- **elbow-length chemical resistant gloves**

**If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water. After each day's use wash gloves, face shield or goggles and contaminated clothing. Wash hands after use.**

## FIRST AID

**If poisoning occurs, contact a doctor or Poisons Information Centre. Phone 131 126.**

## MATERIAL SAFETY DATA SHEET

If additional hazard information is required, refer to the Material Safety Data Sheet. For a copy phone 1800 067 108 or visit our website at www.syngenta.com.au

## MANUFACTURER'S WARRANTY AND EXCLUSION OF LIABILITY

Syngenta has no control over storage, handling and manner of use of this product. Where this material is not stored, handled or used correctly and in accordance with directions, no express or implied representations or warranties concerning this product (other than non-excludable statutory warranties) will apply. Syngenta accepts no liability for any loss or damage arising from incorrect storage, handling or use.

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* Registered trademark

| | |
|---|---|
| Batch Number | |
| Date of Manufacture | |

Drummuster
(100-1000 L refillable)

Barcode

# CAUTION

**KEEP OUT OF REACH OF CHILDREN**
**READ SAFETY DIRECTIONS BEFORE OPENING OR USING**

## DIRECTIONS FOR USE

### Restraints

DO NOT apply to waterlogged soils
DO NOT apply if heavy rains or storms that are likely to cause runoff are forecast within 2 days of application

| Crop | Weeds | Rate/ha | Critical Comments |
|---|---|---|---|
| Barley, Wheat | **Annual Ryegrass (*Lolium rigidum*) including control of Group D resistant populations** | **2.5 L** | **Apply pre-emergent and incorporate mechanically by sowing operation (IBS). Application should be made to a moist seedbed up to 7days prior to sowing and sufficient rain to thoroughly wet the top 3 to 4 cm of soil should occur within 10 days after spraying. Avoid soil throw into adjacent seeding rows or sites where furrow walls may collapse. Refer to crop tolerance, incorporation and tillage requirements under General Instructions.** |
| | **Annual Ryegrass (*Lolium rigidum*), Red and White Fumitory, Paradoxa Grass (Canary Grass), *Phalaris* spp, Sand Fescue, soil surface Wild Oats, Wireweed (Hogweed)** Suppression **of Brome Grass, Deadnettle, Rough Poppy, Yellow Burr Weed** | **1.5 to 2.5 L plus 0.8 to 1.5 L of a 480 g/L trifluralin** | **DO NOT use less than 2.5 L/ha BOXER GOLD where Group D resistance is confirmed or suspected. Use of BOXER GOLD below 2.5 L/ha alone or in a tank-mix WILL NOT be effective in the control of Group D resistant Annual Ryegrass nor to delay the onset of herbicide resistance development. Refer to Tank Mixes under General Instructions.**<br>**Apply pre-emergent and incorporate mechanically by sowing operation (IBS). Application should be made to a moist seedbed up to 24 hours prior to sowing and sufficient rain to thoroughly wet the top 3 to 4 cm of soil should occur within 10 days after spraying. Avoid soil throw into adjacent seeding rows or sites where furrow walls may collapse.**<br>**Use 1.5 L/ha of a 480 g/L trifluralin in minimum tillage knife/blade point systems only as per trifluralin label. Attention to sowing speed and soil throw is important to ensure crop safety. This is especially critical at higher use rates. Risk of crop injury may increase where greater than 1 L/ha trifluralin 480 g/L is applied with 2.5 L/ha BOXER GOLD. Always refer to use recommendations on trifluralin label regarding soil type restrictions and incorporation timing and rate selection under different tillage systems.**<br>**This mixture is recommended for control or suppression of additional weeds, on sandy soils where product movement into the seeding zone poses a crop safety risk or where good soil moisture cannot be assured. Refer to crop tolerance, incorporation and tillage requirements under General Instructions.** |

| Crop | Weeds | Rate/ha | Critical Comments |
|---|---|---|---|
| Barley, Wheat ***continued*** | **Toad Rush (*Juncus bufonius)*** | **1.25 to 2.5 L** | **DO NOT use less than 2.5 L/ha BOXER GOLD where Group D resistant Annual Ryegrass is confirmed or suspected. Use of BOXER GOLD below 2.5 L/ha WILL NOT be effective in the control of Group D resistant Annual Ryegrass nor to delay the onset of herbicide resistance development. Refer to Tank Mixes under General Instructions.**<br>**Apply pre-emergent and incorporate mechanically by the sowing operation (IBS). Application should be made to a moist seedbed up to 7days prior to sowing and sufficient rain to thoroughly wet the top 3 to 4 cm of soil should occur within 10 days after spraying. Avoid soil throw into adjacent seeding rows or sites where furrow walls may collapse.**<br>**Use upper label rate where longer residual control is required or in situations where crop competition is minimal. Refer to crop tolerance, incorporation and tillage requirements under General Instructions.** |

**NOT TO BE USED FOR ANY PURPOSE, OR IN ANY MANNER, CONTRARY TO THIS LABEL UNLESS AUTHORISED UNDER APPROPRIATE LEGISLATION**

## WITHHOLDING PERIODS

***Barley, Wheat:***
**Harvest:** **NOT REQUIRED WHEN USED AS DIRECTED**
**Grazing:** **DO NOT GRAZE OR CUT FOR STOCK FOOD FOR 10 WEEKS AFTER APPLICATION**

## GENERAL INSTRUCTIONS

BOXER GOLD is a short residual, soil applied, pre-emergent herbicide that is absorbed by the roots and shoots (coleoptile) of germinating seedlings with inhibition of growth in the meristematic region. Foliar uptake is possible but of lower effect. Upstream translocation in the plant occurs but movement in the phloem is very unlikely. Best activity can be expected from applications before or shortly after the germination of target weeds.

The product should be applied to a moist smooth seedbed free of soil clods and emerged weeds. Product efficacy may be reduced by improper incorporation, high levels of crop or trash residues, stones or foreign matter and in areas of extremely high weed seed density such as header rows. For optimal efficacy and crop safety avoid shallow seeding and ensure accurate seed placement that avoids placement of seed in the herbicide band. Avoid water repellent soils, soils subject to waterlogging or where furrow walls are likely to collapse. Duration and effectiveness of weed control will depend on use rate, soil type and rainfall or irrigation after application. Adequate rainfall should occur within 10 days of application, as this herbicide requires sufficient available soil moisture to ensure soil movement and uptake by emerging weed seeds.

### Crop Tolerance

The selectivity of BOXER GOLD in cereals is a combination of positional and physiological selectivity. Positional selectivity must be maintained by sowing at adequate depth below the herbicide band. The physiological selectivity of BOXER GOLD is given by the ability of cereals to metabolise the herbicide to inactive compounds more rapidly than susceptible weed species. Environmental factors such as rainfall events following application and soil type will influence product movement into the seed zone. Crop damage may result where tank mixed with other herbicides, heavy rainfall follows sowing, in the event of crop stresses including frost or in sandy soils with high leaching potential. Risk of crop damage may be exacerbated where varieties with short coleoptile length are planted in conjunction with the use of some fungicide seed treatments.

## Tillage System

***IBS with knife or blade points:*** Working speed should ensure adequate incorporation of product but avoid soil throw into the adjacent seeding row. Use of presswheels will minimise potential for herbicide to be dragged back into seeding rows. Weed control may be reduced in seeding rows as a result of concentration of herbicide in crop inter-rows. A knife or blade point is defined as being <12 mm in width, having no wings, inverted T or blade and is generally on a minimum 200 mm row spacing.
***Full disturbance or conventional cultivation, including trailing harrows/prickle chain:*** Care should be taken to ensure seed placement below the herbicide band as crop damage may result where seed is sown to shallow. Consult trifluralin label for tank mix rate selection.

**PRODUCT MUST BE INCORPORATED INTO THE SOIL WITHIN 7 DAYS OF APPLICATION**

BOXER GOLD is an emulsifiable concentrate that mixes readily with water. Fill the spray tank to one quarter full. Add BOXER GOLD and continue adding water to make up to the final spray volume. Agitate while mixing and spraying.
When tank mixing wettable powder or water dispersible granule formulations should be added to the tank first followed by suspension concentrates (flowables), water soluble salts then BOXER GOLD or other emulsifiable concentrate formulations. Maintain thorough agitation during mixing and application. Agitate tank mixes vigorously if allowed to stand. Note: Tank mix spray solutions should NOT be left standing in the vat overnight.

### Compatibility

BOXER GOLD is compatible with any 1 of the following herbicides: 2,4-D (amine and ester), carfentrazone, glyphosate, Logran 750 WG, Logran B-Power, metsulfuron methyl, oxyfluorfen, Spray.Seed® 250 Herbicide and trifluralin. ***Always refer to plant back restrictions on the label of the tank mix partner.***
BOXER GOLD is compatible with any 1 of the following insecticides: alpha cypermethrin, bifenthrin, chlorpyriphos, dimethoate, Karate® with Zeon® Technology Insecticide and Supracide®400 Emulsifiable Concentrate Insecticide.
BOXER GOLD is compatible with liquid Urea Ammonium Nitrate (UAN) fertilisers provided the spray solution is under constant high agitation.
As formulations of other manufacturers' products are beyond the control of Syngenta and water quality varies with location, all mixtures should be tested prior to mixing commercial quantities.

### Application

Apply by ground rig only in a minimum of 50 L water/ha. Water rate selection should be based on soil type and stubble load. Stubble loads above 40 to 50% ground coverage can reduce weed control below acceptable levels. Water volumes greater than 70 L/ha are recommended in order to reduce the impact of stubble in direct drill or minimum tillage systems. Use a nozzle delivering spray quality in the medium to very coarse spray range. DO NOT apply by air.

### Resistant Weeds Warning

| GROUP | E | K | HERBICIDE |
|---|---|---|---|

BOXER GOLD Herbicide is a member of the thiocarbamates and amides group of herbicides. This product has the inhibitors of mitosis and herbicides with diverse sites of action modes of action. For weed resistance management, this product is a Group E and Group K herbicide. Some naturally occurring weed biotypes resistant to this product and other Group E and/or Group K herbicides may exist through normal genetic variability in any weed population. The resistant individuals can eventually dominate the weed population if these herbicides are used repeatedly. These resistant weeds will not be controlled by this product or other Group E and/or Group K herbicides. Since the occurrence of resistant weeds is difficult to detect prior to use, Syngenta Crop Protection Pty Limited accepts no liability for any losses that may result from the failure of this product to control resistant weeds. Advice as to strategies and alternative treatments that can be used should be obtained from your local supplier, consultant, local Department of Agriculture, Primary Industries Department or a Syngenta representative.

### Resistance Management

Large numbers of healthy surviving weeds can be an indication that resistance is developing. Efforts should be made to prevent seed set of the surviving weeds. DO NOT make more than 1 application of a Group E or Group K herbicide with the inhibition of fat acid synthesis mode of action to a crop in the same season.

If the user suspects that the target weed population is resistant to herbicides with this mode of action, BOXER GOLD or other Group E or Group K herbicides should not be used. Strategies to minimise the risk of herbicide resistance are available. The above recommendations should be incorporated into an Integrated Weed Management (IWM) Program that uses a diverse range of options to manage grass weeds and avoids over reliance on any one method of control. Consult your farm chemical supplier, consultant, local Department of Agriculture or Primary Industries, or local Syngenta representative for details.

#### *Tank Mixes*

Application of BOXER GOLD at less than 2.5 L/ha when tank mixing for Annual Ryegrass control WILL NOT be effective in the control of Group D resistant populations nor to delay the onset of herbicide resistance development. Tank mixing of herbicides is only effective in managing resistance where a lethal dose rate of each herbicide is applied. Whilst a tank mixture of 2 herbicides of differing modes of action at sub-lethal dose rates may still provide a high level of weed control, the risk of developing resistance to multiple modes of action is increased. Tank mixtures of BOXER GOLD with trifluralin are only recommended where targeting additional weed species, on sandy soils where soil moisture is limiting or where product movement into the seeding zone poses a crop safety risk.

### PRECAUTION

**Re-entry Period:** DO NOT allow entry into treated areas until the spray has dried unless wearing cotton overalls (or equivalent clothing) and chemical resistant gloves. Clothing must be laundered after each day’s use.

### PROTECTION OF CROPS, NATIVE AND OTHER NON-TARGET PLANTS

DO NOT sow susceptible crops within 9 months of herbicide application.
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.
DO NOT allow spray to drift onto adjacent fallow land.
DO NOT apply on or near shrubs, trees, lawns or crops other than wheat or barley.
DO NOT drain or flush equipment on or near desirable trees or other plants, where their roots may extend, or in situations where by movement of soil or by seepage absorption of the herbicide may occur.

### PROTECTION OF WILDLIFE, FISH, CRUSTACEANS AND ENVIRONMENT

HIGHLY TOXIC TO AQUATIC ORGANISMS. DO NOT contaminate streams, rivers or waterways with the chemical or used containers.
DO NOT apply under meteorological conditions or from spraying equipment which could be expected to cause spray to drift onto adjacent areas, particularly wetlands, waterbodies or watercourses.

### STORAGE AND DISPOSAL

Store in the closed, original container in a cool, well ventilated area. DO NOT store for prolonged periods in direct sunlight.

#### Refillable containers

Empty contents fully into application equipment. Close all valves and return to (point of supply/ designated collection point/ other specific collection details) for refill or storage.

#### Other containers

Triple or preferably pressure rinse containers before disposal. Add rinsings to spray tank. DO NOT dispose of undiluted chemicals on site. If recycling, replace cap 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 should not be burnt.

## SAFETY DIRECTIONS

**Will irritate the eyes and skin. Avoid contact with eyes and skin. When opening the container and preparing spray wear:**

- **cotton overalls, over normal clothing, buttoned to the neck and wrist**
- **washable hat**
- **elbow-length chemical resistant gloves**
- **face shield or goggles**

**When using the prepared spray wear:**

- **cotton overalls, over normal clothing, buttoned to the neck and wrist**
- **washable hat**
- **elbow-length chemical resistant gloves**

**If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water. After each day's use wash gloves, face shield or goggles and contaminated clothing. Wash hands after use.**

## FIRST AID

**If poisoning occurs, contact a doctor or Poisons Information Centre. Phone 131 126.**

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# GLOSSARY

| | |
|---|---|
| **Active constituent** | The substance that is primarily responsible for the effect produced by a chemical product. |
| **Acute** | Having rapid onset and of short duration. |
| **Carcinogenicity** | The ability to cause cancer. |
| **Chronic** | Of long duration. |
| **Codex MRL** | Internationally published standard maximum residue limit. |
| **Desorption** | Removal of an absorbed material from a surface. |
| **Efficacy** | Production of the desired effect. |
| **Formulation** | A combination of both active and inactive constituents to form the end use product. |
| **Genotoxicity** | The ability to damage genetic material |
| **Hydrophobic** | Water repelling |
| **Leaching** | Removal of a compound by use of a solvent. |
| **Log $P_{ow}$** | Log to base 10 of octonol water partioning co-efficient. |
| **Metabolism** | The conversion of food into energy |
| **Photodegradation** | Breakdown of chemicals due to the action of light. |
| **Photolysis** | Breakdown of chemicals due to the action of light. |
| **Subcutaneous** | Under the skin |
| **Toxicokinetics** | The study of the movement of toxins through the body. |
| **Toxicology** | The study of the nature and effects of poisons. |

# REFERENCES

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Footnote:
Updated versions of these documents are available on the APVMA website http://www.apvma.gov.au.

# APVMA PUBLICATIONS ORDER FORM

To receive a copy of the full technical report for the evaluation of prothioconazole in the product Redigo Fungicidal Seed Treatment, please fill in this form and send it, along with payment of $30 to:

Colin McCormack
Pesticides Program
Australian Pesticides and Veterinary Medicines Authority
PO Box E240
Kingston ACT 2604

Alternatively, fax this form, along with your credit card details, to:
Colin McCormack, Pesticides Program at 02 6210 4776.

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I enclose payment by cheque, money order or credit card for $__________

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