Australian Government

Australian Pesticides and Veterinary Medicines Authority

Public Release Summary

on the evaluation of the active constituent aclonifen in the product Mateno Complete Herbicide

APVMA product number 89959

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This publication is available from the APVMA website.

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Preface

The Australian Pesticides and Veterinary Medicines Authority (APVMA) is the Australian Government regulator responsible for assessing and approving agricultural and veterinary chemical products prior to their sale and use in Australia. Before approving an active constituent and/or registering a product, the APVMA must be satisfied that the statutory criteria, including the safety, efficacy, trade, and labelling criteria, have been met. The information and technical data required by the APVMA to assess the statutory criteria of new chemical products, and the methods of assessment, must be consistent with accepted scientific principles and processes. Details are outlined on the APVMA website.

The APVMA has a policy of encouraging transparency in its activities and seeking community involvement in decision making. Part of that process is the publication of Public Release Summaries for products containing new active constituents. This Public Release Summary is intended as a brief overview of the assessment that has been conducted by the APVMA and of the specialist advice received from advisory agencies, including other Australian Government agencies and State departments of primary industries. It has been deliberately presented in a manner that is likely to be informative to the widest possible audience to encourage public comment.

About this document

This Public Release Summary indicates that the APVMA is considering an application for registration of an agricultural or veterinary chemical. It provides a summary of the APVMA's assessment, which may include details of:

- the toxicology of both the active constituent and product
- the residues and trade assessment
- occupational exposure aspects
- environmental fate, toxicity, potential exposure and hazard
- efficacy and target crop or animal safety.

Comment is sought from interested stakeholders on the information contained within this document.

Making a submission

In accordance with sections 12 and 13 of the Agvet Code, the APVMA invites any person to submit a relevant written submission as to whether the application for registration of aclonifen in the product Mateno Complete Herbicide should be granted. Submissions should relate only to matters that the APVMA is required, by legislation, to take into account in deciding whether to grant the application. These matters include aspects of public health, occupational health and safety, chemistry and manufacture, residues in food, environmental safety, trade, and efficacy and target crop or animal safety. Submissions should state the grounds on which they are based. Comments received that address issues outside the relevant matters cannot be considered by the APVMA.

Submissions must be received by the APVMA by close of business on 28 December 2021 and be directed to the contact listed below. All submissions to the APVMA will be acknowledged in writing via email or by post.

Relevant comments 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.

When making a submission please include:

- contact name
- company or organisation name (if relevant)
- email or postal address (if available)
- the date you made the submission.

Please note: submissions will be published on the APVMA's website, unless you have asked for the submission to remain confidential, or if the APVMA chooses at its discretion not to publish any submissions received (refer to the public consultation coversheet).

Please lodge your submission using the public consultation coversheet, which provides options for how your submission will be published.

Note that all APVMA documents are subject to the access provisions of the *Freedom of Information Act 1982* and may be required to be released under that Act should a request for access be made.

Unless you request for your submission to remain confidential, the APVMA may release your submission to the applicant for comment.

Written submissions should be addressed to:

Executive Director Registration Management

Australian Pesticides and Veterinary Medicines Authority

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Sydney NSW 2001

Phone: +61 2 6770 2300

Email: enquiries@apvma.gov.au

Further information

Further information can be obtained via the contact details provided above.

Copies of technical evaluation reports covering chemistry, efficacy and safety, toxicology, occupational health and safety aspects, residues in food and environmental aspects are available from the APVMA on request.

Further information on Public Release Summaries can be found on the APVMA website.

Introduction

This publication provides a summary of the data reviewed and an outline of the regulatory considerations for the proposed registration of Mateno Complete Herbicide, which contains aclonifen, an approved active constituent not previously included in a registered product.

Applicant

Bayer CropScience Pty Ltd.

Purpose of application

Bayer CropScience Pty Ltd has applied to the APVMA for registration of the new product Mateno Complete Herbicide, containing 400 g/L aclonifen (in combination with two other approved active constituents, 100 g/L pyroxasulfone and 66 g/L diflufenican), as a suspension concentrate (SC) formulation.

This publication provides a summary of the data reviewed and an outline of the regulatory considerations for the proposed registration of the product Mateno Complete Herbicide.

Proposed claims and use pattern

The proposed product Mateno Complete Herbicide is intended for the pre-emergent or post-emergent control or suppression of various grass and broadleaf weeds in non-durum wheat and barley. The product is to be applied using incorporation by sowing (IBS) or early post-emergent (EPE) at up to 1.0 L/ha in non-durum wheat and 0.75 L/ha IBS in barley using ground boom spray equipment. No aerial application is proposed.

Mode of action

Aclonifen is a herbicidal active constituent for which the mode of action has changed several times and was previously classified as a Group 12 and 14 herbicide. However, as of 2021, it is classified as a group 32 herbicide with the mode of action – Inhibition of solanesyl diphosphate synthase.

The other actives included in this product diflufenican and pyroxasulfone have modes of action corresponding to Groups F and K (under the previous Australian mode of action classification scheme) or Groups 12 and 15 under the international herbicide mode of action classification.

Group F/12 has an inhibition of carotenoid biosynthesis at the phytoene desaturase step (PDS inhibitors) mode of action. Group K/15 has an inhibition of very long chain fatty acid synthesis (VLCFA inhibitors) mode of action.

Aclonifen has activity against many grass and broadleaf weeds, largely through pre-emergence activity. It can be applied pre- or post-emergence to a variety of crops. Major crops treated in Europe include wheat, potatoes, lentils, field peas, maize, sunflower and many minor vegetable and herb crops.

Overseas registrations

The active constituent aclonifen is currently approved for use in several registered products for weed control in many countries within the European Union. The product names include Bandur, Challenge, Emerger and Fenix. In addition, aclonifen is registered for use under product name of Challenge in Algeria, Morocco and Turkey; Prodigo in Chile and Uruguay; and under the name of Valzer in India.

Chemistry and manufacture

Active constituent

The active constituent aclonifen is manufactured overseas. Details of the chemical name, structure, and physicochemical properties of aclonifen are listed below in Tables 1 and 2.

Aclonifen was separately evaluated by the APVMA as a new active constituent under application 88338/120947 and was approved in November 2020.

Aclonifen is an odourless, yellow coloured powder with a melting point of 81.2°C. It is practically insoluble in water (1.4 mg/L at 20°C and pH 5 to 9), and very soluble in acetone, dichloromethane, ethyl acetate, acetonitrile and toluene (>440 g/L). It has a low vapour pressure of 1.6×10-5 Pa at 20°C, suggesting that it has low volatility. Given a Henry's law constant of 3.0×10-3 Pa-m3/mol at 20°C, there will be limited volatilisation from water. Aclonifen is hydrophobic in nature and may have the potential for bioaccumulation. There are no safety properties (for example flammability, explosive, and/or oxidizing) of concern regarding aclonifen. Aclonifen is expected to be stable for at least two years of storage under normal conditions.

Table 1: Nomenclature and structural formula of the active constituent aclonifen

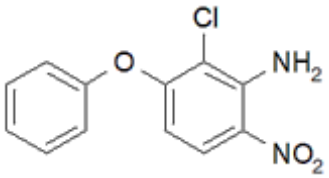
Common name (ISO):	Aclonifen
IUPAC name:	2-Chloro-6-nitro-3-phenoxyaniline
CAS registry number:	74070-46-5
Molecular formula:	C12H9ClN2O3
Molecular weight:	264.7 gmol-1
Structural formula:	

Table 2: Key physicochemical properties of the active constituent aclonifen

Physical form:	Solid
Colour:	Yellow powder
Odour:	No characteristic odour
Melting point:	81.2°C
Boiling point:	The test substance decomposes at 296.6°C
Relative density:	1.5 g/cm3 at 20°C
Stability:	At elevated temperatures, no changes in the active were observed after 2 weeks storage at 54ºC. No adverse reactions with metals or metal ions (iron and aluminium metals and salts) were observed following storage at 54ºC for 2 weeks. Technical aclonifen is therefore expected to be stable in storage for at least 2 years under normal conditions.
Safety properties:	Not considered flammable. Not explosive. Not auto-flammable. Except for photo-degradation in water, the aclonifen technical does not show any chemical incompatibility with oxidising and reducing agents and is essentially non-hazardous.
Solubility in water:	1.40 mg/L (pH 5 to 9) at 20ºC
Organic solvent solubility (at 25 °C):	Methanol: 49.2 g/L Acetone: >730 g/L Ethyl acetate: >600 g/L Dichloromethane: >800 g/L Toluene: 442 g/L Acetonitrile: 482 g/L n-hexane: 4.8 g/L
Dissociation constant (PKa):	pKa=-3.15 (estimated by calculation, no value could be determined experimentally)
Octanol/water partition coefficient (Log Kow/KOW):	log Pow= 4.37 at 20°C
Vapour pressure:	1.6×10-5 Pa at 20ºC 14×10-5 Pa at 35ºC
Henry's law constant:	3.02×10-3 Pa m3/mol
UV/VIS absorption spectra:	ε=18987 L.mol-1.cm-1(λ=238 nm) ε=8431 L.mol-1.cm-1(λ=310 nm) ε=6143 L.mol-1.cm-1(λ=390 nm)
Hydrolysis in water:	Stable in sterile solutions at pH 5, 7 and 9 and 22°C, 50°C and 70°C over 31 days

Formulated product

The product Mateno Complete Herbicide will be manufactured in Australia. Tables 3 and 4 outline some key aspects of the formulation and physicochemical properties of the product.

Mateno Complete Herbicide is an odourless, yellow coloured suspension concentrate. It contains a new combination of three active constituents, 400ºg/L of aclonifen, 100ºg/L pyroxasulfone and 66ºg/L of diflufenican, as a suspension concentrate (SC) formulation. There are no safety properties of concern regarding Mateno Complete Herbicide (for example auto-ignition, self-reactive, explosive, and/or oxidizing). Mateno Complete Herbicide is expected to be stable for at least 2 years storage under normal conditions.

Mateno Complete Herbicide will be available in 1ºL to 1,000ºL HDPE (high density polyethylene) containers.

Table 3: Key aspects of the formulation of the product Mateno Complete Herbicide

Distinguishing name:	Mateno Complete Herbicide
Formulation type:	Suspension concentrate (SC)
Active constituent concentration/s:	400ºg/L aclonifen

Table 4: Physicochemical properties of the product Mateno Complete Herbicide

Physical form:	Yellow suspension liquid
PH:	8.6 (1% aqueous dilution) 7.3 (neat)
Relative density:	1.205 to 1.213ºg/mL at 20ºC
Kinematic viscosity:	224×10^{-6}. m^2/s (shear rate $20^{o}s^{-1}$) 114×10^{-6}. m^2/s (shear rate $100^{o}s^{-1}$)
Pourability:	Pour residue= 3.2% Rinsed residue= 0.2%
Spontaneity of dispersion:	99%
Suspensibility:	98 to 99% suspension at 2.5% (w/v) dilution 98 to 99% suspension at 0.4% (w/v) dilution
Safety properties:	No flash point up to 99ºC. Not classified as a flammable liquid or an explosive and/or as an oxidising substance.
Storage stability:	There was sufficient data to conclude that the product is expected to remain within specifications for at least 2 years when stored under normal conditions.

Recommendations

The APVMA has evaluated the chemistry of the active constituent aclonifen, and associated product Mateno Complete Herbicide, including the manufacturing process, quality control procedures, stability, batch analysis results and analytical methods, and found them to be acceptable. The available storage stability data indicate that the formulated product is expected to remain stable for at least 2 years when stored under normal conditions.

Based on a review of the chemistry and manufacturing details, the registration of Mateno Complete Herbicide is supported from a chemistry perspective.

Toxicological assessment

Aclonifen was assessed using a full package of toxicity data, along with reports from overseas evaluations that had been prepared by the European Food Standard Authority (EFSA, 2008). The data submitted was sufficient to assess the toxicity of aclonifen.

Evaluation of toxicology

Chemical class

Aclonifen is in the diphenylether-class of herbicides and demonstrates a broad spectrum of herbicidal activity. The herbicidal mode of action in a target species involves uptake by the hypocotyl, cotyledons and coleoptile, but not roots, and translocation to the meristems. Following uptake, large amounts of phytoene accumulate, and carotenoids synthesis is inhibited.

Pharmacokinetics

Aclonifen is rapidly, and well absorbed (83%) from the gastrointestinal tract, and extensively metabolised by rats after oral gavage dosing. It is widely distributed, and the highest levels of residues were detected in liver, kidney, lung, thyroid and skin or fur. Residues were completely metabolised via hydroxylation of the phenyl ring, cleavage of the ether bond, reduction of the nitro group and subsequent acetylation, methylation, and phase II type conjugation. Aclonifen is essentially completely excreted within 72 hours post-dosing. After a single oral dose, the major route of elimination of aclonifen was the urine and faeces (~ 50% for each). Studies using aclonifen radiolabelled at the phenoxy position are consistent with studies using the aniline radiolabel position.

A mechanistic study using liver cells from mice, rats, and humans demonstrated that the metabolism profiles of aclonifen in the three species were similar. Notably, there were no significant metabolites (>10% of total recovered) identified in human hepatocyte cultures that were not also found in mouse and/or rat hepatocyte cultures.

Dermal absorption was investigated in in vitro studies using human and rat skin, and in rats in vivo. Low flux rates demonstrated that aclonifen, when applied as an SC formulation, does not rapidly penetrate the skin. A dermal absorption value of 2% was considered appropriate for occupational risk assessment.

Acute toxicity (active constituent)

Aclonifen was of low acute oral, dermal and inhalation toxicity. It was not irritating to the eyes or skin of rabbits but has potential to be a skin sensitiser.

Acute toxicity (product)

Mateno Complete Herbicide is of very low oral toxicity, and low dermal and inhalation toxicity. The product was not irritating to the skin or eyes of rabbits and showed no potential to be a skin sensitiser in a mouse lymph node assay.

Repeat-dose toxicity

The short-term toxicity of aclonifen was investigated in rats, mice, and dogs via dietary administration, and in rats via dermal exposure. Kidney and liver were identified as target organs, and reduced body weights and food consumption were observed in female rats at the highest doses.

The no observed adverse effect level (NOAEL) in mice at 4 weeks was 780 ppm in the diet, equating to 121/143 mg/kg bw/day, based on generalised hepatotoxicity. In three separate 90-day studies in rats, the lowest NOAEL was 50 ppm (3.6/4.2 mg/kg bw/day in M/F, respectively) based on serum albumin, urea, cholesterol, increased liver weights and associated hepatocellular hypertrophy, including increased kidney weight, increased urinary volume, transitional cell hyperplasia, necrosis of papilla (males), and accumulation of test material in cortical tubules.

In a 28-day dermal toxicity study in rats, the NOAEL was 500 mg/kg bw/day based on reductions in body-weight gain associated with reduced food consumption, lower glucose levels in males, and a decrease in white blood cell counts in both sexes. However, the use of an aqueous vehicle reduced the potential for contact between skin and test substance (see section 2B of OECD TG 410; 1981), and thus the overall sensitivity of this study.

Chronic toxicity and carcinogenicity

One chronic aclonifen toxicity study was conducted in mice, and 2 in rats.

In a 2-year study in mice, tumours were seen in bladder, preceded by transitional cell hyperplasia and chronic inflammation. This was determined to be due to crystal formation in urine. The overall NOAEL was 7 mg/kg bw/day, based on decreased body weight gain in both sexes of mouse, increased liver weight, urinary bladder transitional cell hyperplasia; urinary bladder tumours in two males and one female at 700 ppm.

Two studies were conducted in rats. In both studies, reduced body weight and food consumption was observed in females at highest dose. In the second rat study, liver hypertrophy was observed in both sexes. In the second study at the top dose, malignant astrocytoma was observed in 4 of 60 females. Due to:

- the rarity of malignant glioma incidence in female rats in both intra-laboratory and meta-laboratory historical control data
- the reported potential of aclonifen to bind to chromatin in vitro
- known potential of certain anilines to induce reactive oxygen species in the central nervous system (CNS)
- induction of intramyelic vacuolation in the cerebellum and white matter (glial cells) of the brain

the likelihood of the observed tumours being treatment related cannot be ruled out; however, it is noted that there is a clear threshold. This specific, carcinogenic effect was seen in only one species, and was not observed consistently across studies. There was an overall NOAEL for systemic toxicity of 7.6 mg/kg bw/day across the 2 studies, and a NOAEL for carcinogenicity of 86 mg/kg bw/day.

Reproductive and developmental toxicity

There was no evidence of developmental toxicity or reproductive toxicity in an acceptable range of laboratory studies.

In a 2-generation, reproductive toxicity study in rats, the NOAEL for parental toxicity was 8 mg/kg bw/day, and offspring toxicity was 35 mg/kg bw/day, based on decreased body weights and food consumption (M/F only). There were no adverse effects on reproductive outcomes, and therefore the NOAEL was 120 mg/kg bw/day; the highest dose tested.

In a development toxicity study in rats, developmental effects included reduced body weight, corrected body weight gain, and reduced foetal weights with a NOAEL of 60 mg/kg bw/day. In rabbits, no developmental effects were observed at the highest dose tested, and NOAEL was 25 mg/kg bw/day.

Genotoxicity

In a mouse lymphoma gene mutation assay, aclonifen was negative. An Ames test, and in an in vitro chromosomal aberration assay, were also negative. There was no evidence of genotoxicity in an in vivo micronucleus assay, or in an in vivo unscheduled DNA synthesis assay in rat liver. However, there was evidence of the potential for aclonifen to bind chromatin, but not naked DNA. Therefore, aclonifen has the theoretical potential to induce changes in DNA expression.

Neurotoxicity/immunotoxicity

No specific data on immunotoxicity or neurotoxicity was available.

Based on results from repeat-dose toxicity studies, there was no evidence of acute or delayed neurotoxicity or immunological effects.

No data was available on immunotoxicity; however, based on the results form repeat-dose toxicity studies, there was no evidence of immunological effects.

Toxicity of metabolites and/or impurities

All plant metabolites were reported to be present in the rat, except for ‘RPA 407288’, which is present at below 0.05 mg/kg bw. No toxicologically significant degradates were identified.

Health-based guidance values and poisons scheduling

Poisons Standard

Aclonifen is included in Schedule 6 of the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP).

Health-based guidance values

Acceptable daily intake

The acceptable daily intake (ADI) for aclonifen was established at 0.07 mg/kg bw/day based on: the No Observed Adverse Effect Level (NOAEL) of 7 mg/kg bw/day in 2-year dietary studies in rats, and mice and a safety factor of 100 based on inter and intra species variability. In the rats, the NOAEL of 200 ppm (~7.6 mg/kg bw/day) was based on the adverse changes in clinical parameters and decreased body weights at the next higher dose. This NOAEL was supported by a 2-year dietary mouse study reporting a NOAEL of 70 ppm (~7.1/8.3 mg/kg bw/day in M/F), for decreased bodyweights gains, hepatomegaly, reactive tissue hyperplasia in the bladder, and associated neoplastic progression at the next higher dose.

Acute reference dose

No acute reference dose (ARfD) is proposed for aclonifen. An ARfD is considered unnecessary due to its low oral toxicity and the absence of any neurological effects or developmental toxicity after a single dose.

Recommendations

There are no objections on human health grounds to the approval of aclonifen.

There are no objections on human health grounds to the registration of the product Mateno Complete Herbicide, containing 400 g/L of aclonifen, 66 g/L diflufenican and 100 g/L pyroxasulfone when used in accordance with the directions for use (DFU) and adhering to the recommended safety directions.

Residues assessment

The proposed use of diflufenican in cereals in this application represents an increase in rates when compared to currently approved use patterns. The use of pyroxasulfone is currently registered in wheat, at the proposed rate, as a pre-sowing application only. This application is the first proposed use of pyroxasulfone on barley. Aclonifen is a new active constituent that has not previously been registered in a product in Australia, however, temporary MRLs, and a temporary residue definition have previously been established to support a research permit.

Metabolism

The metabolism of aclonifen was investigated for pre- and post-emergence application in root and tuber vegetables (potatoes), cereals (wheat) and pulses (peas). In addition, confined rotational crop studies were conducted in root crops, leafy vegetables and cereals. For target animals, metabolism studies were conducted with lactating goats and laying hens.

No new metabolism data were provided for diflufenican and pyroxasulfone. Metabolism of diflufenican and pyroxasulfone has previously been considered, and residue definitions established. No further consideration of the metabolism of diflufenican or pyroxasulfone was necessary.

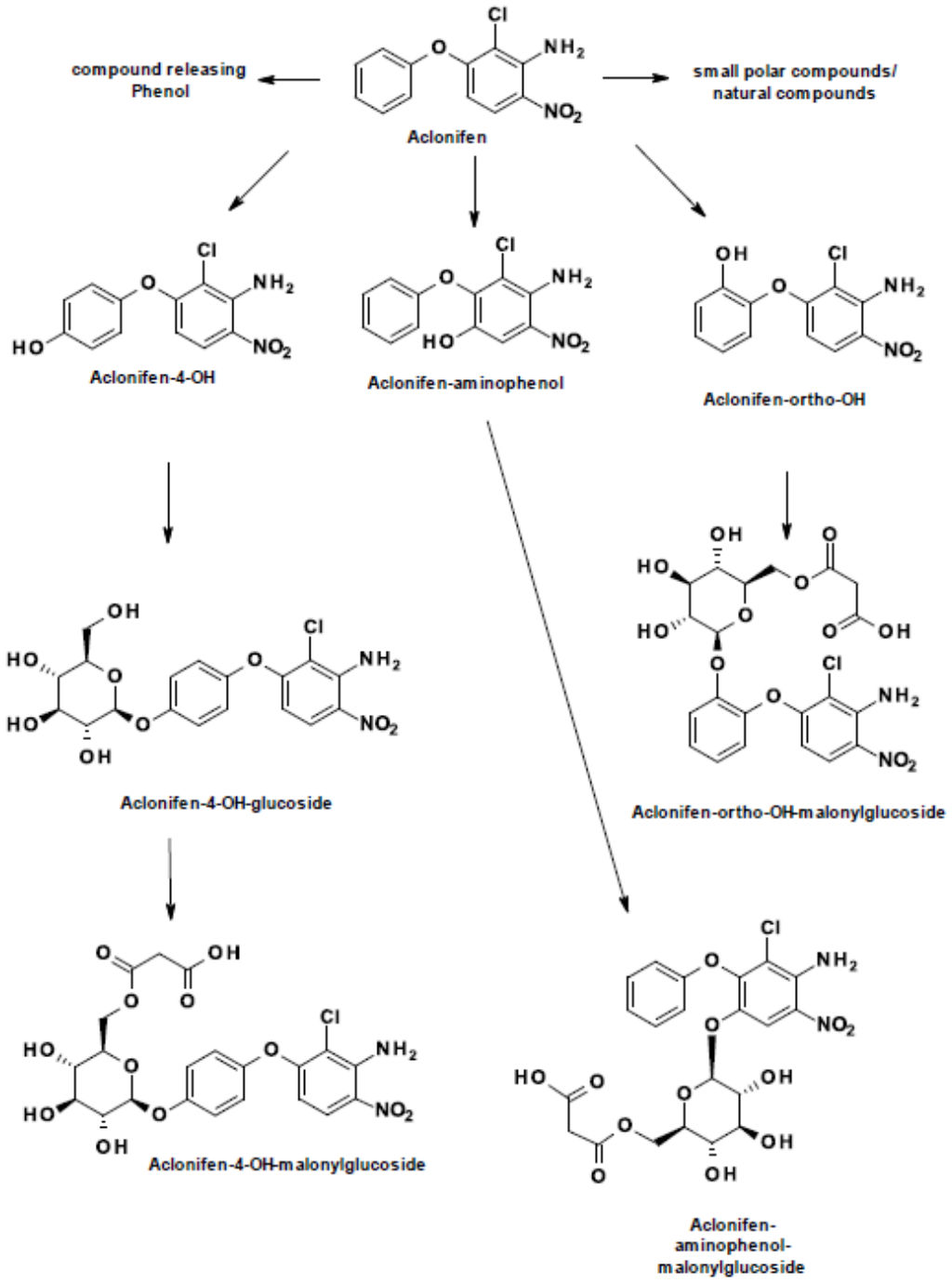
Plants

Parent aclonifen contributed to 24 to 74% Total Radioactive Residues (TRR) in wheat forage, 16 to 29% TRR in wheat hay and 7.5 to 29% TRR in wheat straw. Metabolite D5 (a malonylglucosidyl conjugate of RPA407074 / AE 0561851) was found at 14 to 40% TRR in forage, but at lower amounts in hay and straw. In studies involving the aniline label parent, aclonifen was the predominant component in forage, however Metabolite D5 was found at greater than 10% of the TRR in these studies, following pre-emergence and post emergent application. In a study involving post emergent application of the phenoxy label, the malonyl glucoside conjugate formed in a higher proportion of the forage TRR than parent at 33% (compared to 24% parent). In the available Australian residue trials that analysed the malonyl glucoside conjugate, it was generally found at much lower levels than parent in wheat forage, when it was detected.

In confined rotational crop studies, the radioactive residue for plant uptake became less available over time. In an aniline label study, TRRs remained below 0.1 mg/kg in all 3 rotations. The extractable residue in carrot root consisted exclusively of aclonifen, also the only major component in carrot foliage, and the only identifiable compound detected in spinach. For first rotation (30-day plant back interval) of the phenoxy label study, parent formed 25% TRR in wheat forage, 28% in wheat hay, 12% in wheat straw, up to 52% in Swiss chard (immature) and 45% in carrot root. The malonyl glucoside conjugate was significant in wheat forage, hay, and straw in the first rotation at 43, 24 and 20% TRR respectively, but was not found in the other crops.

The proposed metabolic pathway for aclonifen in plants is summarised below in Figure 1.

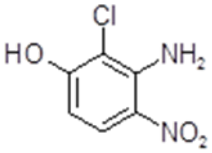
Figure 1: Proposed metabolic pathway for aclonifen in plants



Aclonifen-4-OH = AE 0561851

In an aniline label study, an additional plant metabolite was observed in low quantities (2.4% TRR) in wheat straw. Analysis for the Australian wheat and barley residue trials determined it to be AE0561852:

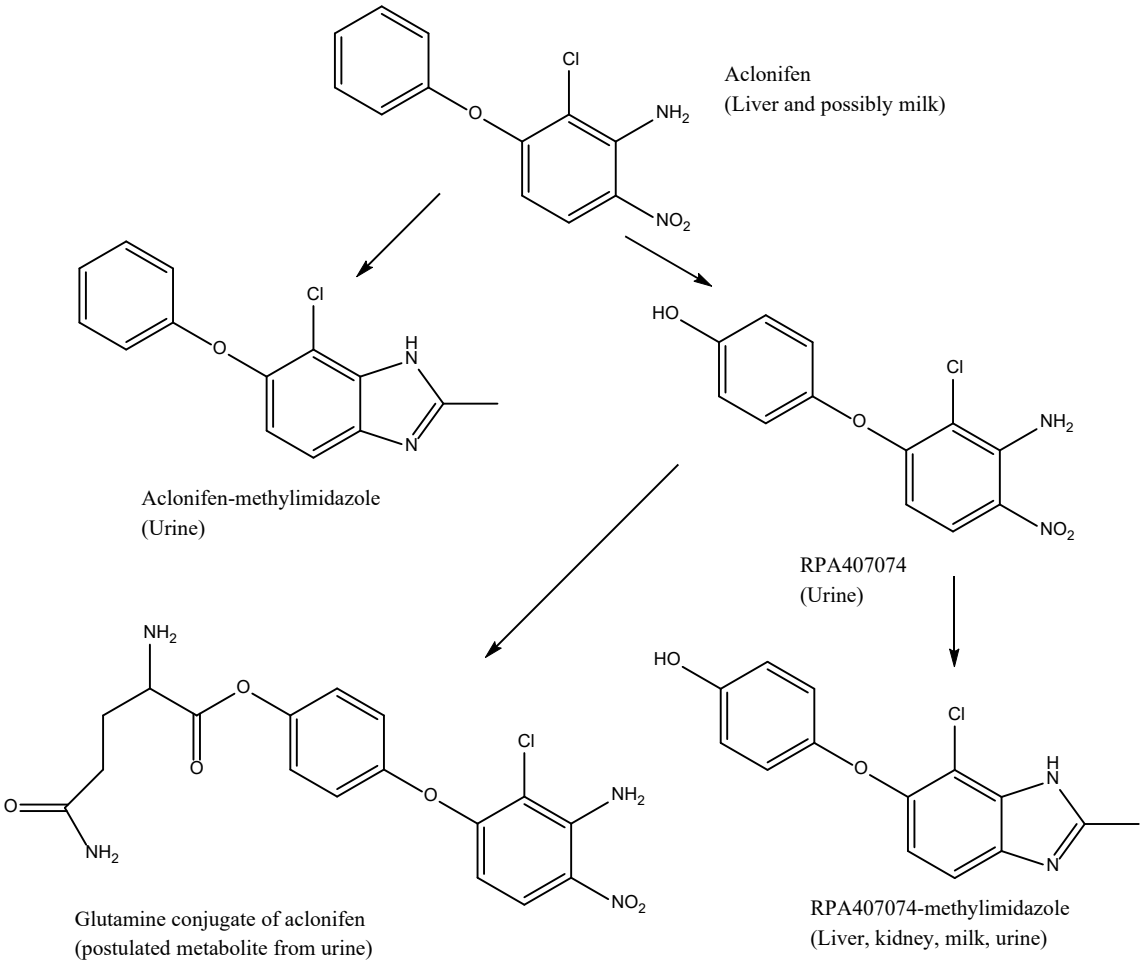
Figure 2: Structure of additional metabolite AE0561852



Target animals

In the low dose goat trial (1.2 ppm in feed, and most relevant to the expected burden), TRRs in milk, fat, muscle and kidney of the lactating goat were below the respective LOQ. In liver, a low total residue occurred above the LOQ, which consisted of a couple of individual compounds with the predominant component being aclonifen. Neither aclonifen, nor any metabolite, individually exceeded 0.01 mg/kg in liver. The nature of the residue was evaluated in the high dose groups. The predominant residue in liver and possibly milk was aclonifen (21% and 39% TRR respectively), while RPA 407074-methylimidazole was predominant in kidney (16% TRR). No residue was observed in meat or fat. The proposed metabolic pathway for aclonifen in lactating goats is summarised below:

Figure 3: Proposed metabolic pathway for aclonifen in lactating goats



[RPA407074-methylimidazole = AE0764380]

In the laying hen study, unchanged aclonifen was detected mainly in fat extracts where it accounted for 73% TRR. M16 and M16a were the most significant metabolites detected in egg and muscle extracts, and these metabolites were also detected in fat and liver. Together they accounted for 52% TRR in eggs, 43% TRR in the muscle, 14% TRR in the fat and 9.5% TRR in the liver. RPA508285 was detected at very low level in fat, egg and muscle extracts, but in total it accounted for 15% TRR in the liver.

Analytical methods and storage stability

Plant commodities

The Australian residue trials for wheat and barley utilised validated analytical methods for the analysis of aclonifen and its metabolites, pyroxasulfone and its metabolites (M-1, M-3, M-25 and M-28), and diflufenican. The LOQ was 0.01 mg/kg for each analyte, and recoveries from fortified control samples were within acceptable limits.

For the active aclonifen and its metabolites AE 0561851 and AE 0561852, samples were extracted by repeated blending with a mixture of acetonitrile/water. The extracts were filtered prior to analysis by LC-MS/MS. For metabolites AE 0561851-glucoside and AE 0561851-malonylglucoside, residues were extracted with aceonitrile/water containing formic acid, and cleaned up on a Chem Elute column prior to analysis by LC-MS/MS.

Aclonifen in animal commodities

Two analytical methods were used in the aclonifen animal transfer study to determine residues of aclonifen and its metabolite AE 0764380.

Cattle milk, cream, muscle, liver, kidney and fat were extracted and analysed for residues of aclonifen, and its metabolite AE 0764380, using high performance liquid chromatography-electrospray ionization/tandem mass spectrometry (HPLC-MS/MS) according to the BAG Method 01618 (method 1). Extraction was with acetonitrile/water, followed by clean-up with addition of magnesium sulphate, sodium chloride and sodium citrate, and centrifuging. The LOQ was 0.01 mg/kg. Single recoveries were in the range of 60 to 120% each, while the mean recovery at each fortification level was in the range of 70 to 110% except for the cream matrix. The recoveries for aclonifen in cream matrix were in the range from 41 to 67% and showed mean values of 56% with BAG Method 01618. No adjustment for recovery is required as residues in milk were below the LOQ at feeding burdens higher than expected.

In parallel, all samples were tested according to the report 68/155-D1141 (Method 2) in order to cross-validate the extraction efficiency of incurred residues of both analytes. Extraction of milk, cream, and fat used methanol-containing trifluoroacetic acid. Muscle, liver, and kidney were incubated with protease. The mixture was placed on ice to terminate the enzymatic reaction. Residues were extracted with tetrahydrofuran, followed by tetrahydrofuran containing trifluoroacetic acid. Clean-up was via addition of magnesium sulphate, sodium chloride and sodium citrate, and centrifuging prior to analysis by HPLC-MS/MS. The LOQ was 0.01 mg/kg. Single recoveries were in the range of 60 to 120% each, while the mean recovery at each fortification level was in the range of 70 to 110% except for cream and muscle matrices. The recoveries in cream matrix for aclonifen with Method 68/155-D1141 were in the range from 41 to 70%, with a mean value of 54%. The

extraction of the metabolite AE 0764380 from the muscle matrix with the Method 68/155-D1141 showed a low recovery of 20 to 36%, with a mean value of 27%. Because the metabolite AE 0764380 is not part of the residue definition, low recovery is not an issue.

Stability of residues in stored analytical samples

It was demonstrated that aclonifen residues were stable when stored at temperatures of –18°C or below. Stability was investigated for at least 24 months in sunflower seed, pea and tomato, and for at least 12 months in maize grain, maize forage, and potato.

In the Australian residue trials, all samples were maintained under freezer conditions, (i.e. –18°C) prior to analysis, and tested within approximately 7 months of collection. This is acceptable for the purposes of the current application.

Residue definition for aclonifen

Plant commodities

The available metabolism data indicates that a residue definition of parent aclonifen alone is suitable for all commodities, except cereal forage where metabolite D5 (a malonylglucosidyl conjugate of RPA407074/AE 0561851/M-01) could be considered in addition to parent.

Available information indicates malonyl glucoside conjugates of aclonifen present in cereal forage, hay, and straw (which may form part of a ruminant diet) would be cleaved to aglycon M-01 (aclonifen-4-OH). Hydroxylation of aclonifen to form M-01, followed by phase II type conjugations with sulfate and glucuronic acid, is the main metabolic pathway in the rat. The malonyl glucoside conjugate will follow the same pathway as parent in animals, and a dairy-cattle transfer study shows that residues of parent, or AE 0764380, above the LOQ after feeding on forage from treated crops is not expected to occur in tissues or milk.

Considering that finite residues are not expected in any animal commodity as a result of the use patterns, with or without the inclusion of malonyl glucoside conjugate (observed at lower levels than parent aclonifen in the Australian residue trials on wheat and barley), the inclusion of this metabolite in the residue definition is not considered necessary.

Given that the available metabolism and residue studies indicate that a low level of total residue is expected in cereal grains, and that parent aclonifen is a significant component of the total residue in cereal animal feed matrices, a residue definition of parent compound only is recommended for aclonifen in commodities of plant origin. This definition is suitable for both enforcement and risk assessment.

Animal commodities

Given that parent aclonifen was the predominant component in goat liver and milk, the expected low dietary burden from wheat, barley grain and straw as a result of the proposed use pattern, and that residues above the LOQ are not expected in tissues or milk from animals grazing on forage, a residue definition as parent aclonifen only is considered appropriate.

The recommended residue definition for aclonifen as parent compound is the same as that currently established in the EU.

Residues in food and animal feeds

Wheat grain

Aclonifen

Residues of parent aclonifen in wheat grain, at harvest, 86 to 187 days after treatment at Z23 at approximately 400 to 600 g ai/ha (1 to 1.5× proposed) were <0.01 mg/kg (n=13). Residues were also <0.01 mg/kg (n=13) after application at 2× proposed or greater. It is noted that in 7 supporting European aclonifen trials, residues in wheat grain at harvest were <0.01 (7) mg/kg after application at 0.81 to 0.90 kg ai/ha at BBCH 01 to 13.

An MRL of *0.01 mg/kg for aclonifen on GC 0654 wheat is considered appropriate to cover the proposed use.

Diflufenican

Residues of diflufenican in wheat grain, at harvest, 86 to 187 days after treatment at Z23 at target rates of 60 to 100 g ai/ha (1 to 1.5× proposed) were <0.01 mg/kg (n=12). Residues were also <0.01 mg/kg (n=8) after application at 2× proposed or greater. No changes are required to the current MRL for diflufenican in wheat of 0.02 mg/kg to cover the proposed use.

Pyroxasulfone

Residues of pyroxasulfone (sum of parent and M1 metabolite, the residues definition for enforcement in plant commodities) in wheat grain, at harvest, 86 to 187 days after treatment at approximately 100 g ai/ha (1× proposed) at Z23 were <0.02 mg/kg (n=13).

No changes are required to the current MRL of *0.01 mg/kg for pyroxasulfone on GC 0080 cereal grains.

Wheat straw

Aclonifen

Residues of parent aclonifen in wheat straw at harvest, and 86-187 days after treatment at Z23 at approximately 400 g ai/ha (1× proposed) were <0.01 (2), 0.02 and 0.18 mg/kg (dry weight). In trials involving application at 600 g ai/ha (1.5× proposed) residues were <0.01 (3), 0.01 (2), 0.03, 0.05, 0.10 and 0.18 mg/kg (dry weight). The combined dataset scaled for application rate is <0.01 (7), 0.02 (2), 0.03, 0.07, 0.12 and 0.18 mg/kg. The OECD MRL calculator recommends an MRL of 0.3 mg/kg based on this dataset. An MRL of 0.3 mg/kg for aclonifen on AS 0081 straw and fodder (dry) of cereal grains is considered appropriate to cover residues in wheat straw from the proposed use.

Diflufenican

Residues of diflufenican in wheat straw, at harvest, and 86 to 187 days after treatment at Z23 at target rates of approximately 60 g ai/ha (1× proposed) were <0.01 (4), 0.033, 0.07 and 0.22 mg/kg (dry weight). In trials involving application at 100 g ai/ha (1.5× proposed), residues were <0.01 (2), 0.07, 0.12 and 0.16 mg/kg (dry weight). The combined dataset scaled for application rate is <0.01 (6), 0.033, 0.05, 0.07, 0.08, 0.11 and 0.22 mg/kg. The OECD MRL calculator recommends an MRL of 0.3 mg/kg (STMR= 0.022 mg/kg, n=12). Given a HR of 0.22 mg/kg, an MRL rounded up to 0.5 mg/kg is recommended for diflufenican on AS 0654 wheat straw and fodder, dry to cover the proposed use on wheat.

Pyroxasulfone

Residues of pyroxasulfone (sum of parent and M1 metabolite) in wheat straw, at harvest, 86-187 days after treatment at approximately 100 g ai/ha (1× proposed) at Z23 were <0.02, 0.05, 0.05, 0.05, 0.06, 0.06, 0.08, 0.09, 0.10, 0.10, 0.12, 0.14 and 0.16 mg/kg (dry weight). The OECD MRL calculator recommends an MRL of 0.3 mg/kg based on this dataset. No changes are required to the current MRL of 0.7 mg/kg for pyroxasulfone on Primary feed commodities to cover residues in wheat straw from the proposed use.

Wheat forage

Aclonifen

Residues of parent aclonifen in wheat forage, at approximately 6 weeks after treatment, at Z23 at approximately 400 g ai/ha (1× proposed) were 0.08, 0.09, 0.59 and 2.94 mg/kg (dry weight). In trials involving application at 600 g ai/ha (1.5× proposed) residues were <0.01 (3), 0.15, 0.37, 1.11, 1.37, 1.97 and 2.97 mg/kg (dry weight). The combined dataset scaled for application rate is <0.01 (3), 0.08, 0.09, 0.10, 0.25, 0.59, 0.74, 0.91, 1.31, 1.98 and 2.94 mg/kg.

Diflufenican

Residues of diflufenican in wheat forage after treatment at Z23 at target rates of approximately 60 g ai/ha (1× proposed) were <0.01, <0.01, <0.01, 0.11, 0.13, 0.22 and 1.0 mg/kg (dry weight). In trials involving application at 100 g ai/ha (1.5× proposed) residues were 0.10, 0.52, 0.79, 1.12 and 1.74 mg/k g (dry weight). The combined dataset scaled for application rate is <0.01, <0.01, <0.01, 0.07, 0.11, 0.13, 0.22, 0.35, 0.53, 0.75, 1.0 and 1.2 mg/kg. The OECD MRL calculator recommends an MRL of 2 mg/kg (STMR 0.175 mg/kg, n = 12). An MRL of 2 mg/kg is considered appropriate for diflufenican on Wheat forage.

Pyroxasulfone

Residues of pyroxasulfone (sum of parent and M1 metabolite) in wheat forage, at approximately 6 weeks after treatment, at approximately 100 g ai/ha (1× proposed) at Z23 were <0.02, <0.02, <0.02, 0.11, 0.14, 0.14, 0.16, 0.18, 0.19, 0.22, 0.32, 0.42 and 0.72 mg/kg (dry weight). The OECD MRL calculator recommends an MRL of 1 mg/kg (STMR 0.16 mg/kg, n = 13). An MRL of 1 mg/kg is recommended for wheat forage to cover the proposed use.

Barley

Pyroxasulfone

No pre-sowing residue data for pyroxasulfone was provided. However, pyroxasulfone is registered for pre-sowing application to cereals (wheat and triticale) at a higher rate than proposed, with a 6-week grazing WHP. The current pyroxasulfone MRLs for cereal grains and primary feed commodities are expected to cover the proposed pre-sowing application to barley.

Barley grain

Aclonifen

Residues of aclonifen in barley grain at harvest, and 141 to 184 days after a pre-sowing application at a target rate of 600 g ai/ha (2× proposed) were <0.01 mg/kg (n = 5). An MRL of *0.01 mg/kg for aclonifen on GC 0640 Barley is considered appropriate to cover the proposed use.

Diflufenican

Residues of diflufenican in barley grain at harvest, and 141 to 184 days after a pre-sowing application at a target rate of 50 g ai/ha (1× proposed) were <0.01 mg/kg (n = 5). Residues were also <0.01 mg/kg after application at a target rate of 100 g ai/ha (2× proposed). No changes are required to the current MRL of 0.05 mg/kg for diflufenican on GC 0640 Barley to cover the proposed use.

Barley straw

Aclonifen

Residues of aclonifen in barley straw at harvest, and 141 to 184 days after a pre-sowing application at a target rate of 600 g ai/ha (2× proposed) were <0.01 (4) and 0.01 (DW) mg/kg. The MRL of 0.3 mg/kg for aclonifen on AS 0081 Straw and fodder (dry) of cereal grains recommended to cover the use on wheat would also be appropriate for the proposed use on barley.

Diflufenican

Residues of diflufenican in barley straw at harvest, and 141 to 184 days after a pre-sowing application at a target rate of 50 g ai/ha (1× proposed) were <0.01 mg/kg (n = 5). Residues were also ≤0.01 mg/kg after application at a target rate of 100 g ai/ha (2× proposed). No changes are required to the current MRL of 0.2 mg/kg for diflufenican on AS 0081 Straw and fodder (dry) of cereal grains.

Barley forage

Aclonifen

Residues of aclonifen in barley forage, at approximately 6 weeks after a pre-sowing application at a target rate of 600 g ai/ha (2× proposed) were <0.01, <0.01, 0.61 and 0.88 mg/kg (dry weight). Scaled for

application rate residues were <0.01, <0.01, 0.31 and 0.44 mg/kg (dry weight). The OECD MRL calculator recommends an MRL of 1.1 mg/kg (unrounded). An MRL of 1 mg/kg is recommended for aclonifen on Barley forage.

Diflufenican

Residues of diflufenican in barley forage approximately 6 weeks after a pre-sowing application at a target rate of 50 g ai/ha (1× proposed) were <0.01,<0.01, 0.06 and 0.18 mg/kg (dry weight). The OECD MRL calculator recommends an MRL of 0.4 mg/kg. An MRL rounded up to 0.5 mg/kg is recommended for diflufenican on Barley forage to cover the proposed use.

Crop rotation

Diflufenican and pyroxasulfone are currently registered for use in rotational situations, at the same or higher rates than proposed for this product. No crop residue-related restrictions on rotational crops is contained on these labels, and no established MRLs cover potential residues in the following crops. The risk of residues of diflufenican and pyroxasulfone in rotational crops is unchanged from that which currently exists.

A European field rotational crop study for aclonifen involved application to bare soil at 2.46 kg ai/ha at 4 different locations, followed by the planting of carrots, lettuce or wheat, at various intervals. Residues in the rotated crops were generally below the LOQ (0.01 mg/kg). The highest residue was 0.041 mg/kg in an immature lettuce sample after the shortest plant back interval (31 days). Scaled for the proposed maximum application rate of 400 g ai/ha, the HR is 0.007 mg/kg. Residues of aclonifen are unlikely to occur in crops grown after wheat or barley treated as proposed.

Residues in animal commodities

A wheat forage MRL of 1 mg/kg has been proposed for pyroxasulfone, which is higher than the current primary feed commodities MRL at 0.7 mg/kg. The current animal commodity MRLs for pyroxasulfone were based on a feeding study in which lactating cattle were fed pyroxasulfone at 1.8, 5.4 or 18 mg/kg, in feed daily for 28 days. In the milk of cattle fed pyroxasulfone at 1.8 or 5.4 mg/kg in feed for 28 days, no residues of parent compound, or the metabolites M-1 or M-3 were observed above the LOQ (0.002 mg/kg). No residues were observed in tissues above the LOQ (0.02 mg/kg) at the next highest dose level (18 mg/kg).

No residues of M1 or M3 above LOQ were detected in the milk or tissues of animals given 0.6 mg/kg each of M-1 and M-3 in feed in another animal feeding study. Given parent was the main component of the wheat forage sample with the HR (with metabolites not detected), current animal commodity MRLs for pyroxasulfone based on an enforcement definition of M3 should remain appropriate.

For diflufenican, a wheat forage MRL is proposed at 2 mg/kg, with a barley forage MRL at 0.5 mg/kg. Given there is a legume animal feeds MRL for diflufenican established at 5 mg/kg, the maximum livestock dietary burden for diflufenican will remain unchanged, and the diflufenican animal commodity MRLs remains appropriate.

For aclonifen, a wheat forage MRL is proposed at 5 mg/kg, with a barley forage MRL at 1 mg/kg. The HR in wheat forage, which can form 100% of the diet, was 2.94 mg/kg (dry weight). The maximum livestock dietary burden would therefore be 2.94 ppm. Estimated aclonifen residues in tissues and milk from a maximum livestock dietary burden of 2.94 ppm are shown below in Table 5.

Table 5: Estimated aclonifen residues in milk and tissue, cattle studies

Feeding level (ppm)	Milk	Muscle	Liver	Kidney	Fat
	Aclonifen residue (mg/kg)				
8.18 (transfer study)	<0.01	<0.01	<0.01	<0.01	<0.01
2.94 (estimated burden)	<0.01	<0.01	<0.01	<0.01	<0.01
Established MRLs	T*0.01 (milks)	T*0.01 (meat)	T*0.01 (offal)		–
Recommended MRLs	*0.01	*0.01	*0.01		

Note: residues of AE 0764380 (= AE 0561851-methyl imidazole) were 0.018 mg/kg in kidney and <0.01 mg/kg in other tissues, and milk after feeding at 8.18 ppm. Estimated residue after feeding at 2.94 ppm is <0.01 mg/kg.

Permanent aclonfien MRLs for mammalian offal, meat, and milk at the LOQ of *0.01 mg/kg are considered appropriate for the proposed uses. The meat and milk MRLs will be designated [in the fat] due to the fat solubility of aclonifen.

Poultry

Residues of aclonifen, diflufenican, and pyroxasulfone are not expected to occur in wheat and barley grain, considering the proposed uses. The current poultry commodity MRLs for diflufenican and pyroxasulfone should remain appropriate. For aclonifen, permanent MRLs for poultry offal, meat and eggs at *0.01mg/kg are considered appropriate. The meat MRL will be designated [in the fat] due to the fat solubility of aclonifen.

Spray drift

The product will be applied by ground application only using medium droplets (or coarser). Diflufenican and pyroxasulfone are currently registered for use in broadacre situations, at the same,or higher rates than proposed for this product, without mandatory no-spray zones required for the protection of international trade.

In the aclonifen dairy cattle transfer study provided by the applicant, residues of parent aclonifen in tissues and milk were all <0.01 mg/kg after feeding at 8.18 ppm. The Regulatory Acceptable Level for livestock areas is therefore 8.18 ppm.

Dietary risk assessment

Chronic, dietary exposure to aclonifen 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 primarily from the 2011–12 National Nutritional and Physical Activity Survey. The NEDI calculation is made in accordance with WHO Guidelines and is a conservative estimate of dietary exposure to chemical residues in food. The NEDI for aclonifen is equivalent to <1% of the ADI. It is concluded that the chronic dietary exposure of aclonifen is acceptable.

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 primarily from the 2011–12 National Nutritional and Physical Activity Survey. NESTI calculations are conservative estimates of short-term exposure (24-hour period) to chemical residues in food. An acute reference dose for aclonifen was considered to be unnecessary. It is not necessary to conduct a NESTI calculation for aclonifen.

Recommendations

The following amendments are required to be made to the APVMA MRL Standard (Table 6).

Table 6: Amendments to the APVMA MRL Standard

Amendments to Table 1		
Compound	**Food**	**MRL (mg/kg)**
Aclonifen		
DELETE:		
GC 0640	barley	T*0.01
MO 0105	edible offal (mammalian)	T*0.01
PE 0112	eggs	T*0.01
MM 0095	meat (mammalian)	T*0.01
ML 0106	milks	T*0.01
PM 0110	poultry meat	T*0.01
PO 0111	poultry, edible offal of	T*0.01
GC 0654	wheat	T*0.01
ADD:		
GC 0640	barley	*0.01
MO 0105	edible offal (mammalian)	*0.01
PE 0112	eggs	*0.01
MM 0095	meat (mammalian) [in the fat]	*0.01

Amendments to Table 1		
Compound	**Food**	**MRL (mg/kg)**
ML 0106	milks [in the fat]	*0.01
PM 0110	poultry meat [in the fat]	*0.01
PO 0111	poultry, edible offal of	*0.01
GC 0654	wheat	*0.01

Amendments to Table 2	
Compound	**Residue**
DELETE:	
aclonifen	{T} aclonifen
ADD:	
aclonifen	aclonifen

Amendments to Table 3		
Compound	**Animal feed commodity**	**MRL (mg/kg)**
Aclonifen		
DELETE:		
	barley forage	T1
AS 0081	straw and fodder (dry) of cereal grains	t0.3
	wheat forage	t5
ADD:		
	barley forage	1
AS 0081	straw and fodder (dry) of cereal grains	0.3
	wheat forage	5
Diflufenican		
DELETE:		
	barley forage	t0.5
	wheat forage	t2
AS 0654	wheat straw and fodder, dry	t0.5
Pyroxasulfone		

Amendments to Table 1		
Compound	**Food**	**MRL (mg/kg)**
DELETE:		
	wheat forage	T1
ADD:		
	wheat forage	1

Assessment of overseas trade aspects of residues in food

For pyroxasulfone and diflufenican, detectable residues are not expected to occur in wheat or barley grain resulting from the proposed uses, and no changes are required to the current MRLs for wheat, barley or animal commodity for these actives. The risk to trade for pyroxasulfone and diflufenican is unchanged. The risk to trade for the new active ingredient, aclonifen, is considered below.

Commodities exported and main destinations

Wheat and barley are considered to be major export commodities, as are commodities of animal origin, such as meat, offal or dairy products, which may be derived from livestock fed feeds produced from treated crops. Residues in these commodities resulting from the use of Mateno Complete Herbicide may have the potential to unduly prejudice trade.

Total exports of barley were 4,683 kilotonnes in 2018/19, valued at $1.84 billion. Total exports of wheat (including flour) were 15,492 kilotonnes in 2017/18, valued at $4.67 billion (ABARES). Major export destinations are summarised below in Table 7.

Table 7: Major export destinations for treated commodities

Commodity	Major destinations
Barley	China, Japan, Korea, Vietnam, the Philippines, Taiwan, Saudi Arabia, Kuwait, United Arab Emirates
Wheat	Indonesia, India, Korea, China, Japan, Thailand, Malaysia, Philippines, Vietnam, Egypt, Nigeria, Yemen, Kuwait, New Zealand

Overseas registrations and approved label instructions

The applicant indicated that the countries with current MRLs for aclonifen include the EU, Switzerland, Turkey and Russia.

Comparison of Australian MRLs with Codex and international MRLs

The Codex Alimentarius Commission (Codex) is responsible for establishing Codex Maximum Residue Limits (CXLs) for pesticides. 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. Aclonifen has not been considered by Codex.

Relevant international MRLs established for aclonifen are summarised below in Table 8.

Table 8: Relevant international MRLs established for aclonifen

Country	Tolerance for residues arising from the use of Aclonifen (mg/kg)						
	Australia	EU	Codex	Japan	Korea	Taiwan	USA
Residue Definition	Aclonifen	Aclonifen	–	–	–	–	–
Wheat	T*0.01 (current) *0.01 (proposed)	*0.01	–	–	–	–	–
Barley	T*0.01 (current) *0.01 (proposed)	*0.01	–	–	–	–	–
Edible offal (mammalian)	T*0.01 (current) *0.01 (proposed)	*0.01 (cattle kidney, liver)	–	–	–	–	–
Meat (mammalian)[in the fat]	T*0.01 (current) *0.01 (proposed)	*0.01 (cattle fat, meat)	–	–	–	–	–
Milks [in the fat]	T*0.01 (current) *0.01 (proposed)	*0.01 (milk)	–	–	–	–	–

Potential risk to trade

Export of treated produce containing finite (measurable) residues of aclonifen 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.

Detectable residues are not expected to occur in wheat or barley grain from the proposed uses. For animal commodities, aclonifen MRLs are proposed at the LOQ of *0.01 mg/kg. The risk to trade is considered to be low.

Work health and safety assessment

Health hazards

Mateno Complete Herbicide was of very low acute oral, low dermal, and low inhalation toxicity. The product was not a skin or eye irritant and has no potential to be a skin sensitiser. Dermal absorption of 2% was determined using a rat in-vivo supported by a rat and human in vitro study.

Occupational exposure

Exposure during use

Mateno Complete Herbicide is intended for use as pre-emergent or post-emergent control or suppression of various grass and broadleaf weeds in wheat (not durum wheat) and barley. The product will be applied at a maximum rate of 1 L/ha in 70 to 100 L water by a groundboom spraying equipment.

Exposure during use is likely to result from mixing and loading the products, along with applying the product. The Occupational Pesticide Handler Exposure Calculator (US EPA 2020) using default work rate assumptions was used to model expected risks resulting from the use of the product at the proposed label rate. Risks were acceptable for all mixing and loading activities, with high margins of exposure. Similarly, applicator risks for use by groundboom spraying equipment were also acceptable.

Exposure during re-entry or rehandling

Risks associated with re-entry to treated areas were calculated using the US EPA Occupation Pesticide Re-entry Calculator (2021) using the surrogate database for dislodgeable foliar residues in the calculations. Risks associated with systemic exposure following treatment were acceptable on day 0, and no re-entry statement is required.

Public exposure

The product is intended for professional use and is not expected to be used or applied by members of the public.

Bystander exposure to spray drift was assessed using the APVMA Spray Drift Risk Assessment Tool with an RAL of 642.05 g/ha. It was determined that no buffer zones are required for the protection of bystanders from spray drift associated with the application of the product.

Recommendations

The following first aid instructions, safety directions and precautionary (warning) statements are recommended for the product label.

First aid instructions

If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 131 126; New Zealand 0800 764 766.

Safety directions

When preparing spray and using the prepared spray, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing). Wash hands after use. After each day's use, wash contaminated clothing.

Precautionary (warning) statements

Warning Statements are not required.

Restraints/Restrictions

DO NOT allow bystanders to come into contact with the spray cloud

DO NOT apply by aircraft

Re-entry or Re-handling Statement

Not required.

Environmental assessment

Fate and behaviour in the environment

Soil

The degradation of aclonifen has been investigated in a series of laboratory studies under aerobic, sterile, and anaerobic conditions. The potential effect of sunlight upon this degradation has also been studied.

In total, the rate of degradation of aclonifen has been determined in nine aerobic soils at 20 to 22°C, 2 aerobic soils at 10°C, and 2 anaerobic soils. All degradation was described by simple first-order (SFO) kinetics and the geomean DT_{50} values were 66 days in aerobic soils at 20 to 22°C, 220 days in aerobic soils at 10°C, and 7.4 days in the anaerobic soils. Up to 64 to 88% bound residues were formed after 90 to 161 days, with low mineralisation under both aerobic conditions (up to 12%) and anaerobic conditions (up to 1.7%).

When aclonifen was incubated on a soil surface, the presence of light slightly accelerated the degradation rate, giving a DT_{50} of approximately 75 days (compared to no degradation on soil surfaces in the dark). Up to 5.3% bound residues were formed with low (4.1%) mineralisation.

Under sterile conditions aclonifen was relatively stable confirming that its metabolism is largely microbially mediated. Bound residues and material bound to aqueous soluble soil colloids were observed under sterile conditions at relatively constant levels throughout the incubation period, but at lower levels than observed in microbially viable soils. This is indicative of metabolites of aclonifen also forming bound residues with time in microbially active soils and possibly binding to aqueous soluble soil colloids.

Aclonifen dissipated at a moderately fast rate in soil at locations across Europe and followed SFO or first-order multi-compartment (FOMC) kinetics. DT_{50} values derived for modelling purposes ranged 31 to 195 days (geomean 86 days). There was no correlation of dissipation rates observed in field studies with organic carbon content or pH values of soils. The cropping history of the site appears to be an influencing factor in the degradation rate of aclonifen in soil. The degradation rate of aclonifen at sites which contained a crop or had contained a crop in the years preceding the trial was much more rapid than those which had been left fallow for a number of years. Although the DT_{90} values of the field dissipation of aclonifen in Northern Europe could exceed 365 days, no accumulation of aclonifen residues in soil for up to three years after application was observed.

Freundlich adsorption/desorption studies have been conducted in eight soils, selected to cover a wide range of properties with respect to organic carbon content, soil pH and clay content. In all soils investigated aclonifen was shown to be very strongly adsorbed with Koc values that predict that it is immobile in soil. The calculated Freundlich adsorption coefficients (Kf) ranged from 59 to 265 (mean 125 L/kg). In one, the 1/n value was 1.0, with a linear relationship between the concentration in soil and solution for this soil, with the amount absorbed being independent of concentration. The relationship between the soil and solution concentration for the other seven soils was nonlinear with 1/n values ranging from 0.84 to 0.89 (mean 0.86), which may be may be indicative of increased competition for binding sites in these soils and consequently greater adsorption at lower concentrations. When corrected for organic carbon content of the soil, the Koc values obtained ranged from 4140 to 10612 L/kg (mean 5952 L/kg).

The results of column leaching studies confirmed that aclonifen and aged residues of aclonifen were immobile in soil with between 92 to 98 % of applied radioactivity retained in the upper treated layer of soil leaching columns. The amount of radioactivity in the leachate did not exceed 0.2 % of applied.

Water

In the laboratory studies on hydrolytic, photolytic, and biological degradation in aquatic systems it was found that aclonifen is degradable in biologically active systems while it is stable to abiotic degradation.

Aclonifen is stable to hydrolysis in buffer solutions of pH 5, 7 and 9 at temperatures ranging 22 to 70°C. Photolysis in buffered solution at pH 7 takes place to a certain, but not high extent. A DT_{50} value of 197 days was found in an experimental study with values at 52°N calculated to range from 8.3 days in summer and 58 days in winter.

Surface water mineralisation was shown to be slow with DT_{50} values ranging 206-361 days under aerobic conditions. However, in water/sediment systems aclonifen moved quickly to sediment and water phase DT50 values derived for modelling purposes ranged 2.6 to 3.4 days (geomean 3.0 days). Whole system degradation was slower and described by FOMC kinetics. The modelling DT_{50} was calculated to range 50 to 61 days (geomean 55 days) within low mineralisation (up to 1.3%). The formation of 66 to 76% bound residues in the sediment after 180 days was found to be a major elimination process. No major metabolites were observed in either the water or sediment phase.

Air

The vapour pressure of aclonifen is 1.6×10^{-5} Pa at 20°C with a Henry's Law constant of 3.0×10^{-3} Pa m^3/mol at 20°C and thus would not be expected to be found in any significant concentration in the air. A soil volatility study has confirmed that aclonifen is not found in any significant concentration in air (<2.5% volatilised after 24 hours). Finally, the theoretical rate of degradation of aclonifen in air following reaction with hydroxyl radicals was rapid with a calculated DT_{50} of 0.84 days.

Effects and associated risks to non-target species

Terrestrial vertebrates

Aclonifen has low toxicity to mammals (LD_{50} 5596 mg ac/kg bw, *Rattus norvegicus*) and birds (LD_{50} >2000 mg ac/kg bw, three species tested). Following long-term dietary exposure in reproductive toxicity studies, reduced F1 and F2 body weights were observed in mammals at doses as low as 35 mg ac/kg bw/day (NOEL 8.0 mg ac/kg bw/d, *Rattus norvegicus*), while no adverse effects were observed in birds at the highest dose (NOEL 141 mg ac/kg bw/d, *Coturnix coturnix japonica*). Mammalian toxicity studies conducted with aclonifen including two-generation and teratogenicity evaluations, produced no evidence of endocrine disrupting potential.

MATENO COMPLETE HERBICIDE has low toxicity to mammals (LD_{50} >934 mg acs/kg bw, *Rattus norvegicus*). Based on low toxicity of each of the active constituents, the combination product is not expected to be toxic to birds.

Therefore, risks of the combination product to terrestrial vertebrates are considered to be acceptable and no protection statements are required.

Risks of Mateno Complete Herbicide to terrestrial vertebrates were determined to be acceptable assuming direct dietary exposure within the treatment area at the maximum rate. Although the log K_{ow} of 4.7 indicates potential for bioaccumulation of aclonifen, a food chain assessment indicated that any accumulated residues in earthworms or fish are not expected to reach levels harmful to predators under the proposed conditions of use. In addition, based on toxicokinetic studies, biomagnification is not expected along the food chain. No protection statements are therefore required for terrestrial vertebrates.

Aquatic species

Aclonifen has moderate toxicity to fish (lowest LC_{50} 0.67 mg ac/L, *Oncorhynchus mykiss*) and aquatic invertebrates (lowest EC_{50} 1.2 mg ac/L, *Daphnia magna*), and high toxicity to algae (lowest E_rC_{50} 0.012 mg ac/L, *Desmodesmus subspicatus*) and aquatic plants (E_rC_{50} 0.011 mg ac/L, *Ceratophyllum demersum*).

Mateno Complete Herbicide has moderate toxicity to fish (LC_{50} 0.51 mg acs/L, *Oncorhynchus mykiss*) and aquatic invertebrates (EC_{50} 1.6 mg acs/L, *Daphnia magna*) and high toxicity to algae (lowest E_rC_{50} 0.0016 mg acs/L, *Raphidocelis subcapitata*), and aquatic plants (E_rC_{50} 0.014 mg acs/L, *Lemna gibba*).

Based on the high toxicity of Mateno Complete Herbicide and its active constituents, aclonifen and pyroxasulfone[1] to algae and aquatic plants, a protection statement is required on the label to identify the hazard.

Following long-term exposure to aclonifen, reduced survival of fish fry was observed at concentrations as low as 0.11 mg ac/L (NOEC 0.043 mg ac/L, *Pimephales promelas*), reduced growth of aquatic invertebrates was observed in a dose-dependent manner (EC_{10} 0.014 mg ac/L, *Daphnia magna*), and reduced emergence of sediment dwellers was observed at concentrations as low as 100 mg ac/kg dry sediment (NOEC 32 mg ac/kg dry sediment, *Chironomus riparius*). No long-term effects were observed in sediment dwellers in water spiked tests at the highest concentration tested (NOEC 0.47 mg ac/L, *Chironomus riparius*).

A species sensitivity distribution (SSD) of E_rC_{50} values has been generated for primary producers exposed to aclonifen based on nine algal species and four aquatic macrophyte species. The HC_5 from the SSD was determined to be 12 µg ac/L. An assessment factor of 3 was applied which results in a regulatory acceptable level (RAL) of 4.0 µg ac/L for aclonifen.

Spray drift risks to aquatic species are driven by the high toxicity of the Mateno Complete Herbicide to algae (RAL 0.61 mg acs/L). A mandatory buffer zone of 150 metres and a maximum boom height of 0.5 metres is required to mitigate these risks.

Runoff risks of aclonifen and pyroxasulfone were determined to be acceptable when accounting for real world slopes in the growing regions, and different soil profiles, provided the product is not applied when a runoff event is expected soon after application. General runoff restraints are required to mitigate this risk.

[1] Pyroxasulfone E_rC_{50} 0.0041 mg ac/L, *Raphidocelis subcapitata*

Bees and other non-target arthropods

Aclonifen has low toxicity to adult *Apis mellifera* and *Bombus terrestris* by contact exposure (LD_{50} >100 µg ac/bee) and oral exposure (LD_{50} >107 µg ac/bee), and moderate toxicity to bee larvae (LD_{50} 48 µg ac/bee, *Apis mellifera*). The SC formulation had no influence on toxicity. Following continuous dietary exposure for 10 days, mortality of adult bees increased in a dose-dependent manner (LDD_{10} 34 µg ac/bee/d, *Apis mellifera*). Reduced larval emergence was also observed following repeated dietary exposure to 80 µg ac/bee during the larval development period (NOEL 40 µg ac/bee, *Apis mellifera*).

Based on the low toxicity of each of the active constituents to adult bees following both oral and contact exposure, Mateno Complete Herbicide is similarly not expected to be toxic to bees.

Risks of Mateno Complete Herbicide to bees were determined to be acceptable assuming direct dietary and/or contact exposure following application to blooming plants within the treatment area at the maximum rate. No protection statements are therefore required for bees.

Other non-target arthropods

In Tier 1 (glass plate) laboratory toxicity tests, fresh-dried residues of an SC formulation of aclonifen resulted in LR_{50} 104 g ac/ha for indicator species of predatory arthropods (*Typhlodromus pyri*) and LR_{50} >3,000 g ac/ha for indicator species of parasitic arthropods (*Aphidius rhopalosiphi*). There are several Tier 2 extended laboratory studies available for *T. pyri* with exposure to treated leaves including potato, bean, and cowpea. In these extended laboratory tests, toxicity was significantly decreased. Most studies could not define LR_{50} or ER_{50} values as exposure levels were not high enough, however, they ranged from >120 g ac/ha to >1800 g ac/ha. One study where the dose/response was sufficient to obtain defined endpoints resulted in a LR_{50} of 2336 g ac/ha and an ER_{50} of 601 g ac/ha. Testing of additional species and substrates resulted in ER_{50} >2400 g ac/ha (*Chrysoperla carnea*, bean leaves), ER_{50} >3300 g ac/ha (*Poecilus cupreus*, quartz sand), ER_{50} >3000 g ac/ha (*Pardosa* sp., sandy soil) and ER_{50} >3300 g ac/ha (*Aleochara bilineata*, quartz sand).

In Tier 1 (glass plate) laboratory toxicity tests, fresh-dried residues of Mateno Complete Herbicide demonstrated some toxicity to indicator species of predatory arthropods (LR_{50} 106 g acs/ha, *Typhlodromus pyri*) and parasitic arthropods (LR_{50} 724 g acs/ha, *Aphidius rhopalosiphi*). In extended laboratory tests, fresh-dried residues on natural substrates had low toxicity to the predatory mite (ER_{50} >707 g acs/ha, *Typhlodromus pyri* on leaves) and the rove beetle (ER_{50} >707 g acs/ha, *Aleochara bilineata* on soil).

Risks of Mateno Complete Herbicide to beneficial arthropods were determined to be acceptable assuming direct contact exposure to fresh-dried residues on foliage or soil within the treatment area at the maximum rate. No protection statements are therefore required for beneficial arthropods.

Soil organisms

Aclonifen has moderate toxicity to soil macro-organisms such as earthworms (LC_{50corr} 150 mg ac/kg dry soil when tested as technical active; LC_{50corr} 97 mg ac/kg dry soil when tested as an SC formulation, *Eisenia fetida*). Following long-term exposure, increased mortality was observed at soil concentrations as low as 42 mg ac/kg dry soil (NOEC 13 mg ac/kg dry soil, *Hypoaspis aculeifer*). Aclonifen did not affect soil processes such as nitrogen transformation at exaggerated soil concentration (NOEC up to 18 mg ac/kg dry soil when tested as the active constituent; NOEC up to 40 mg ac/kg dry soil when tested as an SC formulation).

Based on relatively low toxicity of each of the active constituents, Mateno Complete Herbicide is not expected to adversely affect soil processes such as nitrogen transformation. Based on available data on the individual active constituents, any toxicity to soil macro-organisms such as earthworms would be attributed to aclonifen.

Risks of Mateno Complete Herbicide to soil organisms were determined to be acceptable assuming direct exposure to maximum predicted residues in the top 5 cm of soil without interception by the crop. No protection statements are therefore required for soil organisms.

Non-target terrestrial plants

Tier 2 (dose-response) toxicity testing was conducted with an SC formulation of aclonifen for both pre-emergent (seedling emergence) and post-emergent (vegetative vigour) exposure of 13 crop species. There was a wide range of sensitivities with oilseed rape being the most sensitive species following pre-emergent exposure (ER_{50} 20 g ac/ha, *Brassica napus*) and lettuce being the most sensitive species following post-emergent exposure (ER_{50} 41 g ac/ha, *Lactuca sativa*). Based on an SSD analysis of the ER_{50} values, HC_5 values were determined to be 20 g ac/ha (pre-emergence, 11 species) and 19 g ac/ha (post-emergence, 6 species).

Tier 2 toxicity testing was also conducted for Mateno Complete Herbicide for both pre-emergent (seedling emergence) and post-emergent (vegetative vigour) exposure of 10 crop species. There was a wide range of sensitivity with ryegrass being the most sensitive species following pre-emergent exposure (ER_{50} 9.6 g acs/ha, *Lolium perenne*), and tomato being the most sensitive species following post-emergent exposure (ER_{50} 36 g acs/ha, *Solanum lycopersicon*), Based on a SSD analysis of the ER_{50} values, lower limit HC_5 values were determined to be 5.7 g acs/ha (pre-emergence, 9 species) and 20 g acs/ha (post-emergence, 8 species).

Spray drift risks to non-target terrestrial plants are driven by the high toxicity of the Mateno Complete Herbicide following pre-emergent exposure (RAL 5.7 g acs/ha). A mandatory buffer zone of 30 metres at a maximum boom height of 0.5 metres is required to mitigate risks to off-target vegetation. Because diflufenican and pyroxasulfone have residual activity, a precautionary statement is also advised to avoid the chemicals reaching the soil environment of non-target plants.

Recommendations

In considering the environmental safety of the proposed use of Mateno Complete Herbicide, the APVMA had regard to the toxicity of the active constituent and its residues, including metabolites and degradation products, in relation to relevant organisms and ecosystems. Based on the outcome of the risk assessment, the APVMA is satisfied that the proposed use of the product meets the environmental safety criteria when used according to label directions, which includes the following restraints and protections statements to address environmental risks.

Restraints

DO NOT apply by aircraft

DO NOT apply if heavy rains or storms are forecast within 3 days

DO NOT irrigate to the point of runoff for at least 3 days after application

Buffer zones for boom sprayers

Application rate	Boom height above the target canopy	Mandatory downwind buffer zones	
		Natural aquatic areas	Vegetation areas
Up to 1.0 L/ha	0.5 m or lower	150 metres	30 metres

Protection of crops, native and other non-target plants

Toxic to flora. DO NOT apply or drain or flush equipment on or near native or non-target trees or other plants or on areas where their roots may extend or in locations where the chemical may be washed or moved into contact with their roots.

Protection of wildlife, fish, crustaceans and environment

Very toxic to aquatic life. DO NOT contaminate wetlands or watercourses with this product or used containers.

Efficacy and safety assessment

Proposed product use pattern

The proposed product Mateno Complete Herbicide is intended for the pre-emergent or post-emergent control or suppression of various grass and broadleaf weeds in non-durum wheat and barley. The product is to be applied using incorporation by sowing (IBS) techniques at up to 1.0 L/ha. in non-durum wheat and 0.75 L/ha in barley. This product can also be applied early post emergence (EPE) using ground boom spray equipment at 0.75-1.0 L/ha in wheat only.

Efficacy and target crop/animal safety

Efficacy

Efficacy and crop safety was assessed in 81 Australian field trials, conducted in Western Australia, Queensland, South Australia, Victoria and New South Wales between 2017 and 2020. The product (or a tank mix containing the same active constituents) was applied IBS or EPE (up to several weeks after sowing) in accordance with the label directions, at rates ranging from 0.5 L/ha. to 2.0 L/ha. (i.e., 0.5X to 2X maximum label rate).

The trials included appropriate trial design, scientific methodology and assessment parameters, with 3 or 4 replicates. The trial data were typically analysed by one-way Analysis of Variance (AOV) with treatment means compared using an LSD procedure (P=0.05).

Efficacy assessments were made on the reductions in weeds proposed on the label in comparison to registered industry standards, including weed count per m2 and weed biomass. The trials demonstrated:

- control of annual ryegrass, silver grass and toad rush at 0.75-1.0 L/ha. applied by IBS
- control of annual phalaris/paradoxa grass at 1.0 L/ha. applied by IBS
- suppression only of great brome, wild oats or capeweed at 1.0 L/ha. applied by IBS
- control of toad rush, silver grass, prickly lettuce and annual ryegrass (up to 3 leaf) (following an effective pre-emergent annual ryegrass herbicide) at 0.75-1.0 L/ha. applied EPE to non-durum wheat only
- control of capeweed and wild radish at 1.0 L/ha. applied EPE to non-durum wheat only
- suppression only of barley grass, doublegee/spiny emex and annual ryegrass (without application of another registered pre-emergent annual ryegrass herbicide) at 1.0 L.ha. applied EPE to non-durum wheat only.

Several trials showed that there was no obvious incompatibility with many registered herbicides, insecticides, or fertilisers. The main target weeds for this herbicide were well controlled, and other test weeds were either controlled by the product applied alone, or with the assistance of the tank mix partner.

The applicant has also provided a number of trials testing the impact of agronomic practice on efficacy and crop safety outcomes. Tested practices included: sowing depth, rainfall timing and intensity, droplet size and water volume, the number of days prior to sowing/incorporation, and the type of sowing (drill – disc or knife

point press wheel). In these trials, efficacy was variable with some trials showing excellent control and other only satisfactory, but the performance of the product did not appear to correlate to any particular practice. The main impact of agronomic practice was in barely with increased risk of crop damage when planted at greater depths. After discussion with the applicant, it was agreed that these trials tested extreme depths of planting, upto 8 cm, and that risks in the real world will be lower.

Crop safety

Most efficacy trials included assessments of phytotoxicity and biomass reduction. When applied to wheat at the label rate, 0.75 to 1.0 L/ha. no evidence of phytotoxicity was observed. Phytotoxicity (discolouration) and biomass reduction was observed in barley only at higher label rates1.0 L/ha. or 2.0 L/ha., particularly when applied post-emergence. However, the biomass reduction typically resolved completely (or was minimal) at the final assessment prior to harvest and no significant yield losses were observed following treatment at the proposed label rate of 0.75 L/ha in barley (IBS application only) or 1.0 L/ha in wheat (IBS and EPE application).

Where symptoms of crop damage were evident, similar symptoms were observed from application of pyroxasulfone alone, which suggests that pyroxasulfone is responsible and the inclusion of aclonifen and diflufenican in the product formulation is not compounding the risk. Pyroxasulfone has a long history of use, including the registered Bayer product 63998 – SAKURA 850 WG HERBICIDE. Growers looking to use this product will therefore understand potential risk and how these may be controlled.

For following crops, most species and varieties were broadly tolerant of herbicide residues. When applied at 1.5 L/ha (1.5X the maximum proposed rate), a number of legume species showed moderate symptoms of phytotoxicity in the subsequent growing season. At double label rates, barley, sorghum, sunflower and cotton showed significant damage. Damage was most severe in crops under drought stress which is consistent with the cautions on the product label. When used according to the plantback periods and rainfall guides proposed on the product label, safety to following crops is expected.

Resistance management

The 3 active constituents for this product aclonifen, pyroxasulfone and diflufenican, have 3 alternate modes of action corresponding to Groups 12, 14 and 32 of the international herbicide mode of action scheme. Use of this product containing three actives will assist users with controlling resistance risks by treating weeds with three separate modes of action simultaneously. Aclonifen represents the first registration of a Group 32 herbicide in Australia with the mode of action – Inhibition of solanesyl diphosphate synthase. Registration of a new mode of action class and use of combination products such as these is particularly important for the control of grasses in cereal crops where resistant populations, particularly in annual rye grass, are prevalent.

Recommendations

Trial data provided confirmed efficacy and crop safety for the proposed product, when used according to label directions i.e., applied up to 1.0 L/ha IBS to wheat (non-durum) and 0.75 L/ha IBS to barley for the weeds proposed and application at up to 1.0 L/ha early post-emergent in wheat (non-durum).

Labelling requirements

Label Name:	Mateno Complete Herbicide

Signal Headings:	POISON KEEP OUT OF REACH OF CHILDREN READ SAFETY DIRECTIONS BEFORE OPENING OR USING

Constituent Statements:	400 g/L Aclonifen 100 g/L Pyroxasulfone 66 g/L Diflufenican

Mode of Action:	GROUP 32 12 15 HERBICIDE

Statement of Claims:	For the pre-emergence or post-emergence control or suppression of various grass and broadleaf weeds in wheat (not durum wheat) and barley as specified in the DIRECTIONS FOR USE table.

Net Contents:	1-1000 litres

Restraints:	

Directions for Use:	This section contains file attachment. File Name: BA-0247-Mateno-Complete-DFU.docx File Size: 72551 bytes

Other Limitations:	

Withholding Periods:	Harvest: All crops: NOT REQUIRED WHEN USED AS DIRECTED Grazing/Stockfood: All crops: DO NOT GRAZE OR CUT FOR STOCKFOOD FOR 6 WEEKS AFTER APPLICATION

Trade Advice:	

General Instructions:	This section contains file attachment. File Name: Mateno-Complete-GI - RM edited.docx File Size: 76164 bytes

Resistance Warning:	Mateno Complete is a member of three herbicide groups: Aclonifen is a member of the diphenyl ether group of herbicides and acts by inhibiting solanesyl diphosphate. For weed resistance management aclonifen is a Group 32 herbicide. Diflufenican is a member of the phenyl ethera group of herbicides and acts by inhibiting carotenoid biosynthesis via inhibiting phytoene desaturase. For weed resistance management diflufenican is a Group 12 herbicide. Pyroxasulfone is a member of the isoxazoline group of herbicides and is an inhibitor of very long chain fatty acids (VLCFA inhibitors). For weed resistance management pyroxasulfone is a Group 15 herbicide. Some naturally-occurring weed biotypes resistant to Mateno Complete, and other Group 12, 15 and 32 herbicides, may exist through normal genetic variability in any weed population. These resistant individuals can eventually dominate the weed population if these herbicides are used repeatedly. These resistant weeds will not be controlled by Mateno Complete or other Group 12, 15 or 32 herbicide. Do not rely exclusively on Mateno Complete for weed control. Use as part of an integrated weed management program involving herbicides with other modes of action and non-chemical methods of control. CropLife Australia resistance management strategies are available from your local agricultural chemical supplier or at the CropLife Australia website (www.croplifeaustralia.org.au). Refer to these strategies for details of how to manage the build-up of resistant weeds. Since occurrence of resistant weeds is difficult to detect prior to use Bayer CropScience Pty Ltd accepts no liability for any losses that may result from the failure of Mateno Complete to control resistant weeds.

Precautions:	

Protections:	PROTECTION OF WILDLIFE, FISH, CRUSTACEANS AND ENVIRONMENT Very toxic to aquatic life. DO NOT contaminate wetlands or watercourses with this product or used containers. PROTECTION OF CROPS, NATIVE AND OTHER NON-TARGET PLANTS Toxic to flora. DO NOT apply or drain or flush equipment on or near native or non-target trees or other plants or on areas where their roots may extend or in locations where the chemical may be washed or moved into contact with their roots.

Storage and Disposal:	Store in the closed, original container in a dry, cool, well-ventilated area out of direct sunlight. Non-Returnable Containers Triple 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 deliver empty packaging to an approved waste management facility. If an approved waste management facility is not available bury the empty container 500 mm below the surface in a disposal pit specifically marked and set up for this purpose clear of waterways, desirable vegetation and tree roots, in compliance with relevant Local, State or Territory government regulations. Do not burn empty containers or product. Do not re-use container for any other purpose. Returnable Containers Store in the closed, original container in a dry, cool, well-ventilated area out of direct sunlight. If tamper evident seals are broken prior to initial use then the integrity of the contents cannot be assured. Empty product as required into application equipment. Do not attempt to breach the valve system or filling point, or contaminate the container with water or other products. Ensure that equipment used in transfer of the product is disconnected, triple rinsed with clean water and drained after each use. when the container is empty, close all caps and valves and return the container to the point of purchase."

Safety Directions:	When preparing spray and using the prepared spray, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing). Wash hands after use. After each day's use, wash contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 131126; New Zealand 0800 764 766.

First Aid Warnings:	

Restraints

DO NOT apply to wheat beyond crop stage Z23

DO NOT plant durum wheat (Triticum durum) for 21 months after the application of Mateno Complete (refer to Crop Rotation Recommendations for further advice).

DO NOT apply to waterlogged soil.

DO NOT apply more than one application of Mateno Complete per crop, growing season or calendar year.

DO NOT apply Mateno Complete and another pyroxasulfone containing product e.g. Sakura® WG, Sakura Flow in the same crop and growing season.

DO NOT apply if heavy rain has been forecast within 3 days.

DO NOT irrigate to the point of runoff for at least 3 days after application.

DO NOT apply by aircraft.

Spray Drift Restraints

Specific definitions for terms used in this section of the label can be found at apvma.gov.au/spraydrift

DO NOT allow bystanders to come into contact with the spray cloud.

DO NOT apply in a manner that may cause an unacceptable impact to native vegetation, agricultural crops, landscaped gardens and aquaculture production, or cause contamination of plant or livestock commodities, outside the application site from spray drift. The buffer zones in the buffer zone table below provide guidance but may not be sufficient in all situations. Wherever possible, correctly use application equipment designed to reduce spray drift and apply when the wind direction is away from these sensitive areas.

DO NOT apply unless the wind speed is between 3 and 20 kilometres per hour at the application site during the time of application.

DO NOT apply if there are hazardous surface temperature inversion conditions present at the application site during the time of application. Surface temperature inversion conditions exist most evenings one to two hours before sunset and persist until one to two hours after sunrise.

DO NOT apply by a boom sprayer unless the following requirements are met:

- Spray droplets are not smaller than a **MEDIUM** spray droplet size category
- Minimum distances between the application site and downwind sensitive areas are observed (see ‘mandatory downwind buffer zones’ in the table titled ‘Buffer zones for boom sprayers’ below).

Buffer zones for boom sprayers

Application rate	Boom height above the target canopy	Mandatory downwind buffer zones	
		Natural aquatic areas	Vegetation areas
Up to 1.0 L/ha	0.5 m or lower	150 metres	30 metres

DIRECTIONS FOR USE (For use in all States)

IBS APPLICATION			
CROP	**WEED**	**RATE**	**CRITICAL COMMENTS**
Wheat (not durum wheat)	Annual ryegrass (*Lolium rigidum*) barley grass (*Hordeum leporinum*) silver grass (*Vulpia bromoides*, *Vulpia myuros*) toad rush (*Juncus bufonius*)	0.75-1.0 L/ha	Use the higher rate where a higher level of control is required (e.g. higher weed density expected or soils prone to leaching) or where a longer period of residual control is required. Apply pre-sowing onto uncultivated soil and incorporate by sowing (IBS. Avoid throwing treated soil into adjacent crop rows, leaving furrows open or shallow seed depth when sowing. (refer to **Incorporation by Sowing** in **GENERAL INSTRUCTIONS)**. To reduce the risk of crop effects, refer to **Crop Safety** in **GENERAL INSTRUCTIONS.** For best results apply IBS just before sowing (refer to **Interval between Application and Incorporation by Sowing** in **GENERAL INSTRUCTIONS**). *Cultivation:* Grass weed control is optimised when weed seeds are present on, or very close to, the soil surface at the time of application. Apply directly to uncultivated soil. Weed control may be greatly reduced where grass weed seeds have been buried by cultivation prior to sowing. *Ground cover:* Stubble, plant residue, large clods or other impediments to good soil contact can adversely affect weed control, particularly where ground cover exceeds 50%. *Rainfall soon after application:* • Weed control may be adversely affect by insufficient rainfall within 7 to 10 days after application. Adequate rainfall is necessary to facilitate uptake of the product by the germinating weed seeds, however the quantity of rainfall required will depend on many factors including stubble load and other impediments, soil type, the existing soil moisture at sowing, the pattern of rainfall and other considerations. • In soils prone to leaching, rainfall which is sufficiently heavy to cause movement of the herbicide out of the weed seed zone may lead to reduced weed control.
	Annual phalaris or paradoxa grass (*Phalaris paradoxa* only), Suppression* of: great brome (*Bromus diandrus*) and wild oats (*Avena fatua*) *Refer **Suppression of great brome and wild oats** in **GENERAL INSTRUCTIONS** for further details Suppression of capeweed (*Arctotheca calendula*)	1.0 L/ha	

			(Refer to **Application before Incorporation by Sowing**, **Incorporation by Sowing** and **Soil Type** in **GENERAL INSTRUCTIONS**.) Where a suppression level of weed control is provided a follow up application with a suitable post-emergent herbicide is generally required to control remaining plants.

Barley	Annual ryegrass (*Lolium rigidum*) barley grass (*Hordeum leporinum*) silver grass (*Vulpia bromoides*, *Vulpia myuros*) toad rush (*Juncus bufonius*)	0.75 L/ha	Apply only pre-sowing and incorporate by sowing (IBS) using knife points and press wheels onto uncultivated soil. Avoid throwing treated soil into adjacent crop rows, leaving furrows open or shallow seed depth when sowing. (refer to **Incorporation by Sowing** in **GENERAL INSTRUCTIONS)**. To reduce the risk of crop effects, refer to **Crop Safety** and **IMPORTANT CROP SAFETY INFORMATION SPECIFIC TO USE OF MATENO COMPLETE IN BARLEY** in **GENERAL INSTRUCTIONS.** For best results apply IBS just before sowing (refer to **Interval between Application and Incorporation by Sowing** in **GENERAL INSTRUCTIONS**). *Cultivation:* Grass weed control is optimised when weed seeds are present on, or very close to, the soil surface at the time of application. Apply directly to uncultivated soil. Weed control may be greatly reduced where grass weed seeds have been buried by cultivation prior to sowing.

			Ground cover: Stubble, plant residue, large clods or other impediments to good soil contact can adversely affect weed control, particularly where ground cover exceeds 50%. *Rainfall soon after application:* • Weed control may be adversely affect by insufficient rainfall within 7 to 10 days after application. Adequate rainfall is necessary to facilitate uptake of the product by the germinating weed seeds, however the quantity of rainfall required will depend on many factors including stubble load and other impediments, soil type, the existing soil moisture at sowing, the pattern of rainfall and other considerations. • In soils prone to leaching, rainfall which is sufficiently heavy to cause movement of the herbicide out of the weed seed zone may lead to reduced weed control. (Refer **to Application before Incorporation by Sowing**, **Incorporation by Sowing** and **Soil Type** in **GENERAL INSTRUCTIONS**.) Where a suppression level of weed control is provided a follow up application with a suitable post-emergent herbicide is generally required to control remaining plants.

Do not add an adjuvant to Mateno Complete when used alone EPE.

Do not use with seeding systems which leave the crop row open or with shallow soil coverage of the crop.

<table>
<tr><th colspan="5">EPE APPLICATION – wheat only (not durum wheat)</th></tr>
<tr><th>CROP</th><th>WEED</th><th>Weed stage</th><th>RATE</th><th>CRITICAL COMMENTS</th></tr>
<tr><td rowspan="5">Wheat (not durum wheat)</td><td>Suppression of annual ryegrass (Lolium rigidum), Suppression of barley grass (Hordeum leporinum)</td><td>Up to 2 leaf</td><td>1.0 L/ha</td><td rowspan="5">Without an application of a registered pre-emergent annual ryegrass herbicide, Mateno Complete, applied early post-emergence (EPE), will only provide variable suppression of annual ryegrass and should not be relied on to control annual ryegrass.

Apply an effective registered pre-emergent annual ryegrass herbicide before using Mateno Complete EPE for control of annual ryegrass.

Use the higher rate where a higher level of control is required, or where high weed numbers exist (e.g. ryegrass >100 plants/m2) or where a longer period of residual control is required.

Rainfall before and soon after application.
• Weed control may be adversely affected where weeds are not actively growing due to insufficient rainfall before application.

• Grass weed control may be adversely affected by insufficient rainfall within 7 to 10 days after application. Adequate rainfall is necessary to facilitate uptake of the product from the soil by the young weeds (including weeds in the process of germinating and/or weeds yet to emerge), however the quantity of rainfall required will depend on many factors including stubble load, soil type, the existing soil moisture at sowing, the pattern of rainfall and other considerations.</td></tr>
<tr><td>Silver grass (Vulpia bromoides, Vulpia myuros)</td><td>Up to 2 leaf</td><td>0.75 to 1.0 L/ha</td></tr>
<tr><td rowspan="2">Toad rush (Juncus bufonius)</td><td>Up to 2 leaf</td><td>0.75 L/ha</td></tr>
<tr><td>Up to 3 leaf</td><td>1.0 L/ha</td></tr>
<tr><td>Annual ryegrass (Lolium rigidum)</td><td>Up to 3 leaf</td><td>0.75 to 1.0 L/ha (following an effective pre-emergent annual ryegrass herbicide)</td></tr>
</table>

				• In soils prone to leaching, rainfall which is sufficiently heavy to cause movement of the herbicide out of the weed root zone (and the zone where weed seeds may still be germinating) may lead to reduced weed control. Refer to EPE efficacy in **GENERAL INSTRUCTIONS**
	Capeweed (*Arctotheca calendula*) wild radish (*Raphanus raphanistrum*)	Up to 3 leaf	1.0 L/ha alone, or with MCPA LVE 0.44 L/ha	In cold conditions, or where spray coverage is compromised, add MCPA LVE once the crop has reached the required growth stage (as recommended on the MCPA LVE label). A follow up application of a suitable post emergent herbicide may be required to control remaining annual broad leaf weeds.
	Suppression of doublegee/spiny emex (*Emex australis*)	Cotyledon to 2 leaf	1.0 L/ha	A follow up application of a suitable post emergent herbicide may be required to control remaining annual broad leaf weeds.
	Doublegee/spiny emex (*Emex australis*)	Cotyledon to 4 leaf	1.0 L/ha + 600 g/kg metsulfuron methyl at 5 g/ha + BS1000 0.1% v/v	Refer to the tank mix partner label for directions on crop stage.
	Prickly lettuce (*Lactuca serriola*)	Up to 2 leaf	0.75-1.0 L/ha	Use the higher rate where a higher level of control is required (e.g. higher weed density expected or soils prone to leaching).

GENERAL INSTRUCTIONS

Mateno Complete Herbicide is primarily a residual, soil applied, pre-emergent herbicide, also with early post emergence activity. Pyroxasulfone is absorbed by the roots and to a lesser extent the shoots of germinating weeds. Aclonifen and diflufenican are foliar active herbicides with less soil activity than pyroxasulfone. Activity on grass weeds for pre-emergent and early post emergent application is primarily through root uptake, as well as some foliar uptake for early post emergent application. Activity on broad leaf weeds from early post emergence application is primarily via foliar activity. Weed control from pre-emergent application is optimised when Mateno Complete is applied evenly to soil just prior to incorporation by sowing and there is sufficient rainfall soon after sowing to ensure uptake of the herbicide by germinating weeds. Weed control from early post emergent application is optimised when Mateno Complete is applied evenly to the soil and young actively growing weeds and there is sufficient rainfall soon after application to ensure uptake of the herbicide by the emerged weeds.

Application before Incorporation by Sowing

Weeds germinating from depth, weeds just about to emerge or germinated and emerged weeds at sowing that are not controlled by an effective knockdown herbicide at sowing may not be controlled by Mateno Complete.

Ensure complete and even spray coverage of soil is achieved. Poor spray coverage may result from application to ridged or excessively cloddy soil or in situations of high stubble, plant residue or other ground cover. A significant reduction in weed control may result where stubble, plant residue or other ground cover exceeds 50%, and in situations where a ‘cold’ or incomplete burn of stubble results in a mass of material which can act as a physical barrier between the herbicide and germinating weeds – this can be exacerbated in header trails where there may be greater weed seed numbers and higher levels of plant residue. Weed control can be particularly affected where Mateno Complete is applied to a barrier of stubble, plant residue or other ground cover and there is insufficient following rainfall to move the herbicide to the seed and root zone of germinating weeds.

Interval between Application and Incorporation by Sowing

To optimise weed control, sow as soon as practicable after the application of Mateno Complete and no later than 7 days after application.

Incorporation by Sowing

When applied prior to sowing, Mateno Complete should be incorporated by sowing using knife points and press wheels or disc seeding systems (not barley) that are set up to ensure sufficient separation of the crop seed from treated soil, stubble and weeds (see Crop Safety section). Ensure treated soil is not thrown into adjacent furrows. When incorporation is by knife point and press wheels, weeds germinating in or near the seed row (edge of the furrow) may not be controlled. Knife points and press wheel seeding systems are generally safer to the crop than disc seeding systems as they tend to move more treated soil, stubble and weeds away from the crop row and cover the treated soil surface between the crop rows with soil, reducing the risk of Mateno Complete moving and concentrating in the crop row following rainfall. Disc seeding systems that result in minimal soil disturbance and allow the concentration of herbicide in the seeding slot following rainfall will substantially increase the risk of crop damage and should be avoided.

Soil Type

Grass weed control is often more reliable in loam to clay soils, where there is enough rainfall within 7 to 10 days after application to facilitate the uptake of the herbicide by germinating weed seeds. Weed control may be reduced in soils prone to leaching where rainfall after application and sowing is sufficiently heavy to cause movement of the herbicide out of the weed seed zone. Weed control may also be adversely affected by the presence of water repellent soils.

Suppression of great brome and wild oats

Mateno Complete is most effective when grass weed seeds are present on or very close to the soil surface with good soil moisture at the time of application. For this reason, it is recommended that IBS Mateno Complete is applied to uncultivated soil. As the depth of weed seeds increases, control from Mateno Complete tends to decrease. It is rare that all great brome and wild oat seeds will be on the soil surface at the time of Mateno Complete application, especially considering that these seeds may remain viable in the soil for several seasons. Plants may germinate from seeds buried by the sowing operation, by livestock or by weed seed self-burial mechanisms particularly in some soil types (e.g. cracking clays and sand). **Therefore, only partial control or suppression of the great brome or wild oat population should generally be expected.** In these situations, a follow up application with a suitable post-emergent herbicide will generally be required to control remaining plants.

Early Post Emergence (EPE) Application

Annual grass weeds

For early post emergent grass weed control, Mateno Complete should only be used following a pre-sowing application of an effective pre-emergent herbicide relevant for the weed/s being targeted. For example, for the control of up to 3 leaf annual ryegrass in established wheat, Mateno Complete may be applied following the pre-sowing application of trifluralin, Avadex Xtra, Arcade or Boxer Gold IBS. Check with Bayer Crop Science for additional herbicides tested. For reliable control, weeds should be actively growing at the time of application and there should be sufficient rainfall soon after application for the movement of the product into the weed root zone. Grass weed control on sandy soils may be adversely affected where rainfall after application is sufficiently heavy to cause the movement of the herbicide through and out of the weed seed zone.

There may be increased risk of crop damage from application following heavy rainfall in disc sown crops where rainfall is sufficiently heavy to move cause a concentration of herbicide in the crop sowing slot (see **Crop Safety** section).

Annual broad leaf weeds

Ensure complete and even coverage of weeds is achieved and that weeds are actively growing at the time of application. Complete coverage may be adversely affected by shading from the crop, weeds (due to high weed density) and stubble. Mateno Complete should be applied onto young annual broad leaf weeds as directed in the **DIRECTIONS FOR USE** table. The addition of a compatible herbicide (refer to the **Compatibility** section of this label for other compatible products), once the crop has reached the correct stage according to the label of the added compatible product, may improve control, particularly in high weed density situations where shading occurs. Where complete weed control is not achieved, a follow up application using a suitable herbicide may be required to control remaining annual broad leaf weeds.

Crop Safety

General crop safety

Mateno Complete shows good crop selectivity when used as directed. The following directions will help minimise the risk of crop effects.

- Do not plant durum wheat after the application of Mateno Complete as it may be severely damaged. Refer to Crop Rotation Recommendations for further advice.
- Use a seeding system that does not throw treated soil into the adjacent crop row and does not result in treated stubble or weeds close to the germinating crop seed or emerging crop seedling roots. Seeding systems that do not sufficiently cover the seeding row with untreated soil may result in increased crop effects.
- Do not use a combination of both press wheels and a covering device such as harrows or chains when sowing.
- Ensure good crop nutrition and disease control.
- Ensure good control of soil diseases which affect root growth.

The potential for crop damage is increased when there is substantial rainfall after the application of Mateno Complete, especially where this leads to temporary waterlogging. Situations which lead to concentration of herbicide in the planting row, or movement of herbicide to the depth of the crop seed, may also increase the potential for crop damage. This includes the following scenarios;

- Where deep furrows are formed by the sowing operation, soil movement into the crop row may occur due to wind or heavy rainfall or irrigation soon after sowing resulting in concentration of herbicide in the crop row.
- Where the treated soil surface is not covered by soil during the seeding operation (typical of some disc seeding systems) and heavy rainfall results in the movement and concentration of herbicide in the crop row.
- Where soil has a potential for leaching and rainfall moves the herbicide into the crop root zone (typical of some disc seeding systems in lighter soils).
- Where treated stubble is incorporated near the crop seed by the seeding system.
- Where open sowing slots are present at the time of early post emergent application and rainfall results in the movement and concentration of herbicide in the crop row.
- Where shallow sowing results in a concentration of herbicide in the crop seed zone.
- Where soil has a high potential for leaching, heavy rainfall or irrigation between application and crop emergence may result in movement of herbicide into the crop seed zone.

Other circumstances which may increase the potential for crop damage include;

- Where Mateno Complete is applied in tank mixes with other herbicides,
- Where crop vigour is reduced due to factors such as frosts, insect attack, inadequate nutrition or crop disease,
- When weather damaged seed is used and/or with the use of some fungicide seed treatments especially in conjunction with crop varieties with short coleoptile length.

A combination of individual factors which increase the potential for crop damage may increase the extent of crop damage.

Adjuvants and EPE applied crop safety

Tank mixing adjuvant when applying Mateno Complete can increase crop effects. Do not add an adjuvant when applying Mateno Complete alone EPE.

Check the compatibility section of this label when tank mixing with a partner herbicide that recommends an adjuvant.

IMPORTANT CROP SAFETY INFORMATION SPECIFIC TO USE OF MATENO COMPLETE IN BARLEY
Barley is less tolerant than wheat to Mateno Complete. While in most cases barley crops will be unaffected or minimally affected by Mateno Complete, there may occasionally be reduced emergence and, in some situations, severe reductions in barley crop growth which may persist for the length of the growing season. Further, where severe crop growth effects from the use of Mateno Complete in barley are evident, yield reductions may occur, depending on whether such crop growth effects have been compensated for by reduced competition through effective weed control.

Unfavourable crop effects tend to be greatest when either a high-intensity rainfall event follows soon after the sowing of barley, causing treated soil to move into the crop row or soaking rainfall during the early stage of the growing season causes the movement of product into the crop seed zone.

The following measures may reduce the movement of product into the crop seed zone:
- Sow barley as soon as practicable after the application of Mateno Complete.
- Incorporation should only be by knife points and press wheels when sowing barley; do not use harrows or other covering devices (e.g. chains).
- Do not use Mateno Complete where barley is planted with disc seeding systems.
- Avoid using Mateno Complete with barley in a dry seeding situation.
- Avoid sowing situations that result in stubble drag or any other sowing practices that result in treated soil moving into the crop rows.
- Avoid sowing practices and soil types that may result in furrow collapse and subsequent movement of chemical into the crop rows.

Crop effects may be exacerbated by factors that inhibit crop root growth such as root disease, environmental stress (e.g. waterlogging), poor nutrition, soil compaction, presence of a hard pan, poor seed quality, etc.

The following measures may help reduce the extent of crop damage to barley sown following the application of Mateno Complete. However, since intense or soaking rainfall after sowing is the main cause of crop damage in barley, these recommendations cannot be relied upon to prevent serious crop effects:
- Avoid using Mateno Complete in soils prone to waterlogging.
- Do not apply Mateno Complete in conjunction with other pre-emergent herbicides prior to planting barley.
- Use good quality barley seed.
- Do not use barley seed treated with fungicide seed treatments that may shorten the coleoptile and/or delay emergence.

The potential benefits of using Mateno Complete in barley should to be assessed according to the particular circumstances and balanced against the risks outlined above. Always consult your Mateno Complete agent in relation to the appropriate use of Mateno Complete.

Mixing
Shake contents of container well, before using. Ensure sprayer and nozzle filters are completely clean and maintained before preparing the spray mixture. Continuous agitation is required during the full process of

loading and mixing and until the end of the spraying process. Fill the spray tank to 70% full of water and, with the agitators in motion, add the correct amount of Mateno Complete directly to the spray tank. Complete filling the tank with agitators in motion. When other products are to be applied in combination with Mateno Complete, always add any dry products (WP, WG formulations) to the tank slowly first, allowing at least 10 minutes of constant agitation for thorough dispersion, before adding the correct amount of Mateno Complete to the spray tank. Allow enough time under constant agitation (at least 10 minutes) for Mateno Complete to thoroughly disperse before adding subsequent tank-mix products (e.g. EC or SL formulations) to the tank. Apply the spray liquid immediately after mixing the product(s) into the spray tank. Do not allow the spray mixture to remain in the spray equipment over night and/or without constant agitation. Cleaning of the sprayer immediately after the application is very important (see sprayer clean-up).

Application Equipment

Ground Sprayers – Standard boom sprayers only are recommended and must be fitted with by- pass or mechanical agitation. The use of coarse mesh in-line and nozzle filters is recommended. Do not use nozzle filters finer than 50 mesh. It is recommended that 70 to 100 L water/ha is applied with spray minimum MEDIUM droplet size category; refer spray drift restraints section of this label. In some situations (e.g. high stubble loads) high water volumes may give higher levels of control.

Aircraft – DO NOT apply Mateno Complete by aircraft.

Sprayer clean-up

Following the use of Mateno Complete, the spraying equipment should be thoroughly cleaned before it is used for application of other products. Cleaning should occur immediately following the last application of Mateno Complete or before the sprayer is not used for several hours. The spray unit should first be completely emptied by spraying. Then fill the empty sprayer 1/3 full of water to dilute the remaining amount. Then move the sprayer so that all walls are rinsed. Dispose of water (rinsate) in accordance with State regulations. Check the filter and nozzle for residues and clean them if necessary. The sprayer, including all filters and lines, should be thoroughly rinsed with water, to remove all traces of product.

Ensure that the sprayer clean-up is carried out in an area that is clear of waterways, desirable vegetation and tree roots. If using Mateno Complete with a tank-mix partner, refer to the sprayer clean-up instructions for the other product, which may be more rigorous than those for Mateno Complete.

Crop Rotation Recommendations

Mateno Complete breaks down by microbial degradation, which is favoured by warm, moist aerobic soil.

Minimum recropping intervals (months after Mateno Complete application) have been established for Mateno Complete to minimise the risk of damage to following crops (see table below).

However, environmental and agronomic factors make it impossible to eliminate all risk and therefore the potential for damage to following crops exists.

Rainfall of less than the minimum interim rainfall required (see table below) may result in extended recropping intervals. Interim rainfall is the total rainfall between the application of Mateno Complete and planting of the following crop. For recropping with winter crops, where a minimum of 250 mm of interim rainfall is required, if rain from application to the end of spring is less than 125 mm and isolated heavy

summer and autumn falls and break rains are required to achieve the 250 mm interim rainfall, then extended recropping intervals may apply.

Crops	Recropping recommendation for a maximum Mateno Complete at 1.0 L/ha inany growing season or calendar year	
	Minimum recropping interval	Minimum interim rainfall
Wheat (not durum wheat)	0 months	0 mm
Cotton, maize, mung beans, sorghum, soybeansand sunflowers	5 months[1]	150 mm
Barley	0 or 9 months[2]	0 or 250 mm
Canola, chickpeas, faba beans, field peas, lentils, lupins, vetch and subterranean clover	9 months[3]	250 mm
Durum wheat, lucerne, oats, medics	21 months[4]	500 mm

[1] For cotton, maize, mung beans, sorghum, soybeans and sunflowers there may occasionally be some crop stunting or biomass reduction, but the crop growth improves as the season progresses and no yield reductions have been measured.

[2] Barley can be sown immediately after the application of Mateno Complete, at 0.75 L/ha only, where Mateno Complete has not already been incorporated. However, where Mateno Complete has been incorporated into the soil, for example, by a previous sowing operation, barley should not be sown for at least 9 months after the application of Mateno Complete.

Avoid applying Mateno Complete in barley where a product containing pyroxasulfone (e.g. Mateno Complete, Sakura 480 SC or Sakura 850 WG) has been applied the previous year as crop damage may be more severe (pronounced, exacerbated) in some circumstances.

[3]For canola, chickpeas, subterranean clover, faba beans, field peas, lentils, lupins and vetch sown the year after the application of Mateno Complete there may occasionally be some crop stunting or biomass reduction, but the crop growth improves in spring and no yield reductions have been measured.

[4]For oats, durum wheat, lucerne and medics there may occasionally be some crop stunting or biomass reduction, but the crop growth improves as the season progresses and no yield reductions have been measured.

Avoid overlapping the boom spraying when Mateno Complete is applied.

Acronyms and abbreviations

Shortened term	Full term
ac	active constituent
acs	active constituents
ADI	Acceptable Daily Intake (for humans)
ai	active ingredient
bw	Bodyweight
CNS	Central Nervous System
DT_{50}	Time taken for 50% of the concentration to dissipate
DT_{90}	Time taken for 90% of the concentration to dissipate
EA	Environment Australia
EC_{50}	Effective Concentration, median value
EEC	Estimated Environmental Concentration
EPE	Early Post Emergence
ER_{50}	Effective rate, median
E_rC_{50}	Concentration at which the rate of growth of 50% of the test population is impacted
FOMC	First-order multi-compartment
GAP	Good Agricultural Practice
GLP	Good Laboratory Practice
ha	Hectare
HC_5	Hazardous concentration for 5% of a population
HPLC	High Pressure Liquid Chromatography *or* High Performance Liquid Chromatography
IBS	Incorporated By Sowing
IPM	Integrated Pest Management
in vitro	outside the living body and in an artificial environment
in vivo	inside the living body of a plant or animal
kg	Kilogram

Shortened term	Full term
K_f	Fruendlich absorption coefficient
K_{OC}	Organic carbon partitioning coefficient
K_{OW}	Octanol Water 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
LR_{50}	lethal rate, median
LOD	Limit of Detection—level at which residues can be detected
Log K_{OW}	Log to base 10 of octanol water partitioning co-efficient, synonym pK_{OW}
LOQ	Limit of Quantitation—level at which residues can be quantified
mg	Milligram
mL	Millilitre
MRL	Maximum Residue Limit
MSDS	Material Safety Data Sheet
NEDI	National Estimated Daily Intake
NESTI	National Estimated Short Term Intake
NHMRC	National Health and Medical Research Council
NOEC/NOEL	No Observable Effect Concentration or Level
NOAEL	No Observed Adverse Effect Level
OC	Organic Carbon
OM	Organic Matter
ppb	parts per billion
PPE	Personal Protective Equipment
ppm	parts per million
Q-value	Quotient-value
s	Second
SC	Suspension Concentrate

Shortened term	Full term
SFO	Simple first-order
SSD	Species sensitivity distribution
SUSMP	Standard for the Uniform Scheduling of Medicines and Poisons
vmdµg	Microgram
WG	Water Dispersible Granule
WHP	Withholding Period

Glossary

Term	Description
Active constituent	The substance that is primarily responsible for the effect produced by a chemical product
Acute	Having rapid onset and of short duration
Aerobic/ Anaerobic	Aerobic is a process which occurs in the presence of oxygen. Anaerobic processes occur in the absence of oxygen.
Biomagnification	Accumulation of a molecule in organisms with higher order predators containing more of the substance.
Buffer Zone	A distance from a sensitive area that must be maintained during spray operations.
Chronic	Of long duration
Codex MRL	Internationally published standard maximum residue limit
Desorption	Removal of a material from or through a surface
Efficacy	Production of the desired effect
Freundlich adsorption coefficients	A mathematical model of molecule adsorption onto a solid substrate
Formulation	A combination of both active and inactive constituents to form the end use product
Genotoxicity	The ability to damage genetic material
Hydrophobic	Repels water
Leaching	Removal of a compound by use of a solvent or transport of a substance by a solvent. For example leaching of a compound from soil by water
Metabolism	The chemical processes that maintain living organisms
Pharmokinetics	The study of the movement of toxins through the body
Photodegradation	Breakdown of chemicals due to the action of light
Photolysis	Breakdown of chemicals due to the action of light
Systemic Herbicide	Systemic herbicides are absorbed and transported through the plant's vascular system, killing the entire plant.
Toxicology	The study of the nature and effects of poisons

References

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