Public Release Summary
on

Evaluation of the new active

BUTAFENACIL

in the products

LOGRAN B-POWER HERBICIDE & TOUCHDOWN B-POWER HERBICIDE

National Registration Authority
for Agricultural and Veterinary Chemicals

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FOREWORD

The National Registration Authority for Agricultural and Veterinary Chemicals (NRA) is an independent statutory authority with responsibility for assessing and approving agricultural and veterinary chemical products prior to their sale and use in Australia.

In undertaking this task, the NRA works in close cooperation with advisory agencies, including the Department of Health and Aged Care (Chemicals and Non-prescription Medicines Branch), Environment Australia (Risk Assessment and Policy Section), the National Occupational Health and Safety Commission (NOHSC) and State departments of agriculture and environment.

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

The information and technical data required by the NRA to assess the safety of new chemical products and the methods of assessment must be undertaken according to accepted scientific principles. Details are outlined in the NRA's publications *Ag Manual: The Requirements Manual for Agricultural Chemicals* and *Ag Requirements Series.*

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

More detailed technical assessment reports on all aspects of the evaluation of this chemical can be obtained by completing the order form in the back of this publication and submitting with payment to the NRA. Alternatively, the reports can be viewed at the NRA Library Ground Floor, 22 Brisbane Avenue, Barton, ACT.

The NRA welcomes comment on the usefulness of this publication and suggestions for further improvement. Comments should be submitted to the Executive Manager—Registration, National Registration Authority for Agricultural and Veterinary Chemicals, PO Box E240, Kingston ACT 2604.

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LIST OF ABBREVIATIONS AND ACRONYMS

ac	active constituent
ADI	Acceptable Daily Intake (for humans)
AHMAC	Australian Health Ministers Advisory Council
ai	active ingredient
BBA	Biologische Bundesanalstalt fur Land – und forstwirschaft
bw	bodyweight
d	day
DAT	Days After Treatment
DT_{50}	Time taken for 50% of the concentration to dissipate
EA	Environment Australia
E_bC_{50}	concentration at which the biomass of 50% of the test population is impacted
EC_{50}	concentration at which 50% of the test population are immobilised
EEC	Estimated Environmental Concentration
E_rC_{50}	concentration at which the rate of growth of 50% of the test population is impacted
EUP	End Use Product
Fo	original parent generation
g	gram
GAP	Good Agricultural Practice
GCP	Good Clinical Practice
GLP	Good Laboratory Practice
GVP	Good Veterinary Practice
h	hour
ha	hectare
Hct	Heamatocrit
Hg	Haemoglobin
HPLC	High Pressure Liquid Chromatography *or* High Performance Liquid Chromatography
id	intradermal
im	intramuscular
ip	intraperitoneal
IPM	Integrated Pest Management
iv	intravenous
in vitro	outside the living body and in an artificial environment
in vivo	inside the living body of a plant or animal
kg	kilogram
K_{oc}	Organic carbon partitioning coefficient
L	Litre
LC_{50}	concentration that kills 50% of the test population of organisms
LD_{50}	dosage of chemical that kills 50% of the test population of organisms
LOD	Limit of Detection – level at which residues can be detected
LOQ	Limit of Quantitation – level at which residues can be dquantified
mg	milligram
mL	millilitre
MRL	Maximum Residue Limit
MSDS	Material Safety Data Sheet
NDPSC	National Drugs and Poisons Schedule Committee
ng	nanogram
NHMRC	National Health and Medical Research Council
NOEC/NOEL	No Observable Effect Concentration Level
OC	Organic Carbon
OM	Organic Matter
po	oral
ppb	parts per billion
PPE	Personal Protective Equipment

ppm	parts per million
Q-value	Quotient-value
RBC	Red Blood Cell Count
s	second
sc	subcutaneous
SC	Suspension Concentrate
SUSDP	Standard for the Uniform Scheduling of Drugs and Poisons
TGA	Therapeutic Goods Administration
TGAC	Technical grade active constituent
T-Value	A value used to determine the First Aid Instructions for chemical products that contain two or more poisons
µg	microgram
vmd	volume median diameter
WG	Water Dispersible Granule
WHP	Withholding Period

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INTRODUCTION

This publication provides a summary of the data reviewed and an outline of the regulatory considerations for the proposed registration of *LOGRAN B-POWER HERBICIDE and TOUCHDOWN B-POWER HERBICIDE*, which contain the new active ingredient, butafenacil in combination with the two currently approved actives triasulfuron and glyphosate respectively.

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

Copies of full technical evaluation reports on butafenacil, covering toxicology, occupational health and safety aspects, residues in food and environmental aspects are available from the NRA on request (see order form on last page). They can also be viewed at the NRA library located at the NRA offices, Ground Floor, 22 Brisbane Avenue, Barton ACT 2604.

Written comments should be submitted by 8 March 2002 and addressed to:

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Applicant
Syngenta Crop Protection Pty Limited.

Products Details
It is proposed to register *LOGRAN B-POWER HERBICIDE* containing 200g/kg butafenacil and 520g/kg triasulfuron as a wettable granule and *TOUCHDOWN B-POWER HERBICIDE* containing 5g/L butafenacil and 225g/L glyphosate as a suspension concentrate. *LOGRAN B-POWER HERBICIDE* will be formulated overseas and imported fully packaged and labelled ready for sale. *TOUCHDOWN B-POWER HERBICIDE* will be formulated and packaged in Australia. They will be packaged in 1, 1.5, 2 kilogram and 20, 90, 100, 110 litre containers respectively.

Butafenacil inhibits Proto-Porphyrinogen-Oxidase (PPO) in plant chloroplasts. This non-selective herbicide burns plant material on contact and has very limited soil activity. Butafenacil is a pyrimidindione and as such is classified in Australia for weed resistance management purposes as a Group G herbicide.

Triasulfuron is a sulfonylurea that inhibits acetolactate synthase thereby stopping cell division and plant growth. Triasulfuron, a Group B herbicide, is selective and used to control broadleaf weeds pre- and post-emergence in cereals. The in-crop residual activity of triasulfuron in combination with the knockdown provided by butafenacil in *LOGRAN B-POWER HERBICIDE* has been demonstrated to be especially useful as a one pass treatment prior to planting winter wheat. For weed resistance management purposes *LOGRAN B-POWER HERBICIDE* will be a Group BG herbicide.

Glyphosate is a glycine that inhibits the enzyme EPSPS thus preventing synthesis of essential aromatic amino acids needed for protein production. Glyphosate, a Group M herbicide, is non-selective and systemic. It is absorbed by green (photosynthetic) tissue and translocated throughout the plant. It is inactivated on contact with soil. The combination of butafenacil and glyphosate in *TOUCHDOWN B-POWER HERBICIDE* has been demonstrated to be especially useful for pre-plant control of certain weeds that are hard to control with glyphosate alone. For weed resistance management purposes *TOUCHDOWN B-POWER HERBICIDE* will be a Group GM herbicide.

Butafenacil is the active constituent in registered products in Argentina, Brazil, Japan, Switzerland and Thailand which have uses such as broadleaf and annual grass weed control in cotton, citrus, non-crop land, pome fruit, stone fruit, grapes, garlic and onions.

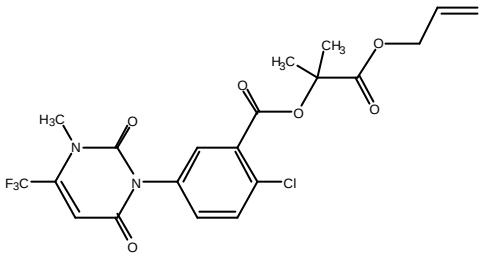
CHEMISTRY AND MANUFACTURE

ACTIVE CONSTITUENT

The active constituent butafenacil is manufactured in Switzerland by Novartis Crop Protection AG at Usine de Monthey, Avenue de l'Industrie, and has been approved by the NRA (Approval Number: 52204).

Chemical Characteristics of the Active Constituent

Common name:	Butafenacil (SA); Butafenacil-allyl (ISO)
Synonyms and code number:	CGA 276854
Chemical name:	2-chloro-5-(3-methyl-2,6-dioxo-4-trifluoromethyl-3,6-dihydro-2H-pyrimidin-1-yl)benzoic acid 1-allyloxycarbonyl-1-methylethyl ester
IUPAC name:	2-chloro-5-[3,6-dihydro-3-methyl-2,6-dioxo-4-(trifluoromethyl)-1(2H)-pyrimidinyl]benzoic acid 1,1-dimethyl-2-oxo-2-(2-propenyloxy)ethyl ester
Chemical Abstracts Service (CAS) Registry Number:	134605-64-4
Molecular formula:	$C_{20}H_{18}ClF_3N_2O_6$
Molecular weight:	474.82 Daltons
Chemical structure:	



Physical and Chemical Properties of Pure Active Constituent (Butafenacil)

Colour	White
Odour	Slight to odourless
Physical state	Fine powder
Melting point	113.0 to 113.6 ^oC
Boiling point	Undergoes thermal decomposition at about 293 ^oC
Density at 20 ^oC	1.37 g/cm^3
Vapour pressure	7.4 x 10^{-9} Pa at 25 ^oC (extrapolated)
Solubility in water	10 mg/L at 25 ^oC
Partition coefficient	Log K_{OW} = 3.19 at 25 ^oC
UV spectrum	?max = 272.0 nm; e = 8850 Lmol^{-1}cm^{-1}
IR spectrum	1747 cm^{-1}, 1727 cm^{-1} and 1678 cm^{-1} – C=O stretch of esters and 2,6-dioxo-2H-pyrimidine ring; 1180 cm^{-1} and 1148 cm^{-1} – C-O stretch; 831 cm^{-1} – C-Cl stretch
Chemical type:	Herbicide
Chemical family:	Imide (Group G herbicide)
Mode of action:	Butafenacil inhibits protoporphyrinogen-oxidase (PPO) in plant chloroplasts, providing rapid knockdown of various broadleaf and grass weeds.

PRODUCTS

1) *LOGRAN B-POWER HERBICIDE*

Formulation Type:	Water dispersible granule (WG)
Active Constituents:	200 g/kg of butafenacil and 520 g/kg of triasulfuron
Mode of Action:	Provide rapid knockdown and residual activity to control various broadleaf and grass weeds, to be used pre-planting wheat

Physical and Chemical Properties of LOGRAN B-POWER HERBICIDE:

Physical State:	Solid granule
Colour:	Light beige to light brown
Odour:	Weak odour
pH value:	4 – 8
Flash Point:	Not applicable
Flammability:	Not applicable
Explodability:	Not applicable
Corrosion Characteristics:	Not corrosive
Storage Stability:	Product is stable when stored in the original container for a minimum of 2 years, ambient temperature.

2) *TOUCHDOWN B-POWER HERBICIDE*

Formulation Type:	Suspension concentrate (SC)
Active Constituents:	5 g/L butafenacil and 225 g/L glyphosate, present as the isopropylamine salt
Mode of Action:	Provide rapid knockdown of various broadleaf and grass weeds, to be used pre-planting cereal crops (except rice)

Physical and Chemical Properties of TOUCHDOWN B-POWER HERBICIDE:

Physical State:	Liquid with a weak sweetish odour
Colour:	Light beige to light brown
Odour:	Weak sweetish odour
Density:	1.10 kg/m^3
pH value:	4 – 6 (1 % aqueous solution.)
Flash Point:	Not applicable
Flammability:	Not applicable
Explodability:	Not applicable
Corrosion Characteristics:	Not corrosive
Storage Stability:	Product is stable when stored in the original container for a minimum of 2 years, ambient temperature.

Conclusion

Based on an assessment of the chemistry and manufacturing details provided by the applicant, the NRA is satisfied that *LOGRAN B-POWER HERBICIDE* and *TOUCHDOWN B-POWER HERBICIDE* will be manufactured to consistent specifications using sources of actives approved by the NRA and will be stable for a minimum of two years.

TOXICOLOGICAL ASSESSMENT

Toxicology

Butafenacil is a new herbicide for the Australian market. It has a similar mode of action to carfentrazone-ethyl, which is another herbicide recently introduced to the Australian market. It is one of two actives in each of the new products called *LOGRAN B-POWER HERBICIDE* and *TOUCHDOWN B-POWER HERBICIDE*.

After ingestion, butafenacil was well absorbed, extensively metabolised and then rapidly and completely eliminated from the body via the bile, faeces and urine. It was poorly absorbed after application to the skin.

Butafenacil had low acute oral, dermal and inhalation toxicity. It was a slight eye irritant but not a skin irritant or skin sensitiser. Both products were considered to be of low oral, dermal and inhalation toxicity. They are likely to be slight eye and skin irritants, but not likely to cause any skin sensitisation.

Toxic concentrations of butafenacil inhibit an enzyme involved in the formation of both the pigment in red blood cells and other enzymes such as those that break down drugs and other foreign chemicals. Red blood cell formation normally occurs in the bone marrow and any impairment in red blood cell formation results in a reduction in red cell numbers in the blood. Butafenacil exposure caused a reduction in the amount of pigment in red blood cells and a reduction in the number of red cells in the blood, probably as a result of the enzyme inhibition discussed above. The liver is the main organ responsible for the breakdown of drugs and other foreign chemicals. Disturbances to this function often result in an altered ability breakdown drugs and other foreign chemicals and changes in the appearance of the liver. Butafenacil exposure caused increased amounts of pigment in the liver (probably the coloured precursors of enzymes responsible for breaking down drugs and other foreign chemicals) and liver enlargement, with increased cell size. All of these effects were observed in repeat dose studies in mice, rats and dogs.

Specific studies indicated that butafenacil does not damage genetic material and long-term studies in mice, rats and dogs indicated that butafenacil does not cause cancer. There were no effects on reproductive behaviour or performance in rats and, at doses that were not toxic to the mother, there were no developmental effects on the rat or rabbit foetus. There was no evidence in rats to indicate that butafenacil was neurotoxic.

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

Toxicokinetics and Metabolism

After oral administration of radioactive butafenacil to rats, most radioactivity (>90%) was excreted within 48 hours, primarily via the faeces, with only small quantities eliminated in the urine. Females eliminated more radioactivity in their urine (15%) than males (4%) at 0.5 mg/kg, but the difference was not as distinct at 100 mg/kg. Residues in selected tissues at both doses were low, with the highest levels found in bone and ovaries. In bile duct cannulated rats, most radioactivity was excreted with the bile (>70%), indicating good absorption of butafenacil from the intestinal tract (>80%). Pre-treatment for 14 days did not influence the kinetic parameters and there was no evidence for bioaccumulation. The metabolite pattern was similar for all dose groups with the exception that unchanged parent was only eliminated in significant amounts in faeces of the high dose group. The major metabolic pathways of butafenacil involved: hydrolysis of the allyl ester; reduction of the uracil ring; hydroxylation of the uracil ring; and uracil ring opening. No parent compound was observed in the bile and the metabolite pattern observed in bile was similar to that observed in rat excreta.

Systemic absorption and skin penetration rates of butafenacil were low after dermal application of an emuslifiable concentrate (EC) formulation to rats and a 500-fold increase in dose led to only a 150-fold increase in dermal penetration rate. Most of the applied dose could be washed off after a 6-hour exposure period and the absorbed dose was excreted mainly via the feces and blood, plasma and non-treated skin had no detectable radioactivity 24 hours after application.

In *in vitro* experiments, total penetration and the rate of penetration of butafenacil were lower in human epidermis than rat epidermis after exposure to an EC formulation. Human epidermis also had a lower permeability coefficient and longer lag time than rat epidermis. Increases in penetration and flux were much lower than the increases in the applied dose in rat epidermis. In human epidermis, the increases in penetration and flux were proportional to the increase from the low to medium doses (approx. 10 times), but at the highest dose increases in penetration and flux were much lower than the increase in the applied dose.

Acute Studies

Butafenacil has low acute oral toxicity in rats and mice (LD_{50}>5,000 mg/kg), low inhalational toxicity in rats (LC_{50}>5,100 mg/m^3), and low dermal toxicity in rats (LD_{50}>2,000 mg/kg). It is a slight eye irritant in rabbits but not a skin irritant in rabbits or a skin sensitiser in guinea-pigs.

The product A 9735 B 100 EC Herbicide (100g/L butafenacil) has low acute oral toxicity in rats (LD_{50}>5,000 mg/kg) and mice (LD_{50}>4,000 mg/kg and <5,000 mg/kg in males; LD_{50} >5,000 mg/kg in females), and low acute dermal toxicity in rats (LD_{50}>4,000 mg/kg). It was a slight eye irritant and a moderate skin irritant in rabbits, and was not a skin sensitiser in guinea-pigs.

The product A 9753 A 460 SC Herbicide (100g/L butafenacil plus 360g/L glyphosate) has low acute oral (LD_{50}>5,000 mg/kg) and dermal (LD_{50}>4,000 mg/kg) toxicity in rats. It was a slight eye and skin irritant in rabbits, and was not a skin sensitiser in guinea-pigs.

Short-Term Study

In rats administered butafenacil dermally at doses of 0, 10, 100 and 1,000 mg/kg bw/day for 6 hours/day, 5 days/week for 4 weeks, there were no mortalities or treatment-related effects at any dose during the study.

In a dietary study rats were administered butafenacil at 0, 20, 100, 300, 1,000 and 4,000 ppm for 3 months. Three males died prematurely at 4,000 ppm. Body weight gain was impaired in

animals of both sexes at 1,000 ppm and 4,000 ppm, and was accompanied by a slight to moderate decrease in food consumption. Anaemia noted at 1,000 and 4,000 ppm in males and at 4,000 ppm in females was characterized by lower haemoglobin concentration, hypochromia, microcytosis, anisochromia and anisocytosis. Trends to microcytosis and hypochromia were also seen in females at 1,000 ppm. Numbers of leukocytes were increased at 4,000 ppm in animals of both sexes and lymphocytes were increased in males at this dose, with higher numbers of most white blood cells in females, and slightly increased platelet counts in males and females. Males showed prolonged prothrombin time (probably as a result of liver toxicity) and slightly lower relative values for eosinophilic and basophilic granulocytes and monocytes without any difference in absolute values. Males at 1,000 and 4,000 ppm showed slightly lower plasma calcium levels, slightly increased chloride and phosphate levels, decreased plasma globulin levels, with lower protein and increased albumin to globulin ratios, lower plasma triglyceride levels and increased activities of alanine aminotransferase, aspartate aminotransferase and alkaline phosphatase. In females, there was a slightly increased gamma-glutamyl transpeptidase activity at 4,000 ppm and plasma phosphate levels were slightly increased at 300 ppm and higher. Urinary porphyrin precursor levels were dose-dependently increased in both sexes at ≥300 ppm, as indicated by a positive reaction for bilirubin and urobilinogen, the effect more pronounced in males with yellow-brown discolouration of urine at 1,000 and 4,000 ppm. The occurrence of epithelial cells, white blood cells or casts in the urine indicated urogenital tract inflammation in both sexes at 4,000 ppm and in males at 1,000 ppm. At 1,000 and 4,000 ppm, mean carcass weights were reduced in both sexes. Relative liver and heart weights were increased in both sexes at 4,000 ppm. Absolute and relative spleen weights and relative kidney weights were increased in males and relative spleen weights were increased in females at 4,000 ppm. Minimal or moderate necrosis of single hepatocytes was observed at 1,000 and 4,000 ppm and areas of marked necrosis were observed in the three males at 4,000 ppm that died. Inflammatory cell infiltration in males at 1,000 ppm and both sexes at 4,000 ppm, pigmentation of hepatocytes and Kupffer cells in both sexes at 4,000 ppm, hypertrophy of hepatocytes and extramedullary haematopoiesis were observed in the liver. One female had necrosis of proximal convoluted tubules in the kidney at 4,000 ppm. Most of the treatment-related effects were reversible at the end of the recovery period. The NOEL for butafenacil was 100 ppm, corresponding to a mean daily intake of 6.12 mg/kg bw/day in males and 7.07 mg/kg bw/day in females.

Dogs were administered butafenacil orally by gelatin capsule daily for three months at doses of 0, 25, 200 and 1,000 mg/kg bw/day. Disturbed haemoglobin synthesis, including lower mean haemoglobin and haematocrit, with associated microcystosis, hypochromasia, anisocytosis and anisochromia of red cells, was noted in males at 1,000 mg/kg at weeks 7 and 13. There was also a trend to lower cell volume and hypochromasia of the erythrocytes in males at 1,000 mg/kg and to lower cell volume in females at 1,000 mg/kg after 13 weeks of treatment. Males at 1,000 mg/kg had slightly lower plasma cholesterol and triglyceride levels, slightly lower plasma albumin and higher globulin levels, resulting in lower albumin to globulin ratios at week 13. Mean absolute and relative liver weight was increased in females at 1,000 mg/kg. Microscopical examination showed a slightly increased incidence of hemosiderosis in the spleen of males at 1,000 mg/kg, and minimal to moderate hemosiderosis in the Kupffer cells of the liver in two males at 1,000 mg/kg. The NOEL was 200 mg/kg bw/day.

Long-Term Studies

Mice received butafenacil in the diet at concentrations of 0, 1, 3, 10 and 60 ppm over 18 months. Haematological effects included lower mean values for erythrocyte count, haemoglobin concentration and haematocrit in males at 60 ppm at weeks 53 and 79, respectively, and for erythrocyte count, haemoglobin and haematocrit at week 79 in males at 10 ppm. Males also had slightly increased neutrophil and monocyte counts at 60 ppm, and a slight thrombocytosis. Mean absolute and relative liver weights were increased in both sexes

at 60 ppm. The incidence of enlarged liver was increased in males at 60 ppm and in females at 10 and 60 ppm. Microscopic examination revealed an increased incidence of hepatocyte necrosis and hyperplasia of Kupffer cells in the liver of males at 10 and 60 ppm, and of females at 60 ppm. In addition, an increased incidence of lipofuscin deposition, and inflammatory cell infiltration was seen in males at 60 ppm. There was no treatment-related increase in the incidence of neoplasms at any dose. Butafenacil was not carcinogenic in mice. The NOEL was 3 ppm in males and 10 ppm in females, equivalent to 0.36 and 1.20 mg/kg bw/day for males and females, respectively.

Rats were administered butafenacil in the diet at doses of 0, 10, 30, 100 and 300 ppm for 24 months. At interim sacrifice, the incidence and/or severity of liver necrosis was increased in both sexes at 100 and 300 ppm. In addition, increased incidence of hepatocellular single cell necrosis (300 ppm) and increased incidence (100 and 300 ppm) and severity (300 ppm) of cholangiofibrosis were noted in females. At the end of the study, higher incidences and slightly increased severity of fatty change in the liver, and slightly higher incidences of increased mitotic activity of hepatocytes were observed in females at 300 ppm. There was no treatment-related increase in the incidence of neoplasms at any dose. Butafenacil was not carcinogenic in rats. The NOEL was 30 ppm, equivalent to 1.14 mg/kg bw/day for males and 1.30 mg/kg bw/day in females, respectively.

Dogs received butafenacil in gelatin capsules at doses of 0, 20, 100, 500 and 1,000 mg/kg bw/day for 12 months. Body weight development was decreased in males at 1,000 mg/kg. Haematological changes included lower haemoglobin concentration and haematocrit in both sexes at 1,000 mg/kg bw/day, lower mean cell volume and mean corpuscular haemoglobin in males at 500 and 1,000 mg/kg bw/day, with associated microcytosis, hypochromasia, anisocytosis and anisochromia of red blood cells, substantiated by increased red cell volume distribution width and haemoglobin concentration distribution width in males and females at 1,000 mg/kg and in females at 500 mg/kg. Minimally lower mean corpuscular haemoglobin concentration values were also noted for males and females at 1,000 mg/kg. Red blood cell counts were increased in females at 500 and 1,000 mg/kg, indicating an erythropoietic regenerative response. Thrombocytosis was observed in animals of both sexes at 1,000 mg/kg, and in females at 500 mg/kg. Slightly lower plasma albumin levels, albumin to globulin ratios, and cholesterol levels were observed in males at 1,000 mg/kg. Carcass weight was slightly reduced in males at 1,000 mg/kg, reflecting the body weight loss in these animals, and mean relative liver weights were increased in males at this dose. Corresponding microscopical findings observed in both sexes at 1,000 mg/kg and in females at 500 mg/kg included minimal to slightly increased periportal rarefaction of liver hepatocytes, most likely due to deposition of glycogen. The NOEL was 100 mg/kg bw/day in dogs.

Reproduction and Developmental Studies

Rats were continuously exposed to butafenacil in the diet for two successive generations at concentrations of 0, 30, 300 and 1,000 ppm. Food consumption was reduced and body weight gain retarded in F_0 parental males at 300 and 1,000 ppm. Mean weight gain of F_1 pups was retarded during lactation days 14 to 21 at 300 and 1,000 ppm, and body weights were reduced at weaning. Mean values for surface righting and eye opening were delayed by 0.1 and 0.3 days, respectively in F_1 pups at 1,000 ppm, consistent with the marked reduction in body weight. Necropsy of the F_0 parents and F_1 pups revealed no treatment-related macroscopic changes and no histopathological findings in the reproductive organs. In the adults, treatment-related findings were observed in the liver, including minimal/mild bile duct hyperplasia in males and females at 300 and/or 1,000 ppm; minimal hepatocellular hypertrophy in males at 1,000 ppm, and minimal/mild foci of necrosis in males at 300 and 1,000 ppm and females at 1,000 ppm. During the pre-mating period, body weights and food consumption of selected F_1 animals of both sexes were considerably lower at 300 and 1,000 ppm, and the weight gain of F_2 pups was retarded. Necropsy of the F_1 parents and F_2 pups revealed no treatment-related

macroscopic changes and no histopathological findings in the reproductive organs. F_1 parental animals at 300 and 1,000 ppm, showed increased incidence in both sexes of minimal/mild bile duct hyperplasia, increased incidence of minimal hepatocellular hypertrophy in males at 1,000 ppm, and minimal/mild necrosis in a few males at 300 and 1,000 ppm, and in females at 1,000 ppm. Butafenacil exerted no toxic effects on the fertility and reproduction of rats at any dose in the study. The NOEL was 30 ppm, corresponding to 2.48 mg/kg bw/day for both sexes.

Butafenacil was administered by gavage at doses of 0, 10, 100 and 1,000 mg/kg bw to mated rats from day 6 to day 15 of gestation. Butafenacil was not maternotoxic, embryotoxic or foetotoxic at the highest dose of 1,000 mg/kg bw. There was no evidence of teratogenic potential. The NOEL was 1,000 mg/kg bw/day.

Butafenacil was administered by gavage at doses of 0, 10, 100 and 1,000 mg/kg bw to mated rabbits from day 7 to day 19 post-coitum. Food consumption and body weight gain were decreased at 1,000 mg/kg. Treatment-related post-implantation loss, almost exclusively in the form of early resorptions, was higher at 1,000 mg/kg. There were no treatment-related foetal external, visceral and skeletal findings. Butafenacil was not teratogenic in rabbits. The NOEL for maternotoxicity and embryotoxicity was 100 mg/kg bw.

Genotoxicity

The results of *in vitro* and *in vivo* genotoxicity studies at the level of genes and chromosomes using bacteria (reverse mutation assay using tester strains *Salmonella typhimurium* and *Escherichia coli*), primary rat hepatocytes (DNA repair test), Chinese hamster ovary cells CHO (mammalian cytogenetic test), rat hepatocytes (unscheduled DNA synthesis) and mouse bone marrow (micronucleus test), were all negative. A borderline positive mutagenic response was found in Chinese hamster lung fibroblasts V79 (mammalian cell gene mutation test) in the presence of metabolic activation.

Special Studies

In rats administered butafenacil at a single oral dose of 2,000 mg/kg, there no treatment-related clinical signs or observations in the Functional Observational and no morphological changes in the central or peripheral nervous system were revealed at neuropathological examination. Butafenacil did not induce neurotoxicity at a dose of 2,000 mg/kg in rats.

Butafenacil was administered to rats in the diet at concentrations of 0, 100, 300 and 1,000 ppm for a period of 90 days. Observations and functional tests conducted during the Functional Observation Battery did not show any effects of toxicological significance. No morphological changes in the central or peripheral nervous system were revealed at neuropathological examination. Microscopic examination of the liver showed inflammatory cell infiltration, cholangiofibrosis of the intrahepatic bile ducts, pigments within Kupffer cells, necrosis of single hepatocytes, cytoplasmic vacuolation, hypertrophy of centrilobular hepatocytes, and an increased mitotic activity of hepatocytes of males at 1,000 ppm. Slight effects were seen at 300 ppm, indicating the beginning of liver necrosis.

The acute oral toxicity of the metabolites of butafenacil, CGA 293730 and CGA 380963, was low (LD_{50}>5,000 mg/kg) in rats. The intermediate of butafenacil, CA 2215 A, had low acute oral toxicity in male rats (LD_{50}>500 mg/kg) and moderate acute oral toxicity in female rats (LD_{50} >200 and <500 mg/kg), moderate acute dermal toxicity in rats (LD_{50} >200 and <400 mg/kg in males, >400 and <2,000 mg/kg in females), and was not a skin or eye irritant in rabbits or a skin sensitiser in guinea-pigs. The acute oral toxicity of the by-product of butafenacil, NOA 402097, was low in rats (LD_{50}>2,000 mg/kg).

The results of *in vitro* genotoxicity studies on the metabolites, CGA 293730 and CGA 380963, the intermediate CA 2215 A and the by-product NOA 402097, at the level of genes and chromosomes using bacteria (reverse mutation assay using tester strains *Salmonella typhimurium* and *Escherichia coli*) and Chinese hamster ovary cells (CHO; mammalian cytogenetic test), were all negative.

Butafenacil was a potent protoporphyrinogen oxidase (Protox) activity inhibitor in liver mitochondrial fractions from mouse, rat and man. Based on IC_{50} values, the strongest inhibition was observed with the mouse enzyme, whereas the rat and human enzymes were slightly (1.9-fold) and considerably (16-fold) less sensitive, respectively. Treatment of cultured mouse and rat hepatocytes with butafenacil led to detectable δ-aminolevulinate synthase activities. Treatment of cultured mouse and rat hepatocytes with butafenacil was without an effect on ferrochelatase activity.

Butafenacil and its free carboxylic acid metabolite, CGA 293731, were potent inhibitors of Protox activity in liver mitochondrial fractions from mouse and rat. In rat liver fractions, both compounds showed the same potency, whereas in mouse liver fractions, butafenacil was slightly stronger. Both butafenacil and CGA 293731 were about 10-fold less active as Protox inhibitors in dog and human liver mitochondrial fractions, with butafenacil more potent than CGA 293731. Both CGA 293730 and CGA 98166 exhibited only very limited Protox inhibitory potencies *in vitro*. Butafenacil was efficiently and predominantly hydrolysed to CGA 293731 by plasma and liver homogenates from all investigated species (except in dogs).

Public Health Standards

Poisons Scheduling

The National Drugs and Poisons Schedule Committee (NDPSC) considered the toxicity of products and their active ingredients and assessed the necessary controls to be implemented under States' poisons regulations to prevent the occurrence of poisoning.

On the basis of its toxicity, the NDPSC has exempted butafenacil from inclusion in a schedule of the Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP). There are provisions for appropriate warning statements and first-aid directions on product labels.

NOEL/ADI

The most susceptible species in long term studies was the mouse. A NOEL for butafenacil-allyl of 0.36 mg/kg bw/day was found for males in an 18 month study, essentially based on haematological effects mostly in males and liver toxicity in animals of both sexes. A rat 2-year study revealed a NOEL of 1.14 mg/kg bw/day for males, based on liver toxicity in animals of both sexes. A safety factor of 100 is considered appropriate for the ADI, due to the extensive toxicology database for butafenacil-allyl. This results in an ADI of 0.004 mg/kg bw/day.

Conclusion

Based on an assessment of the toxicology, it was considered that there should be no adverse effects on human health from the use of this product when used in accordance with the label directions.

RESIDUES ASSESSMENT

Residues in Food

Metabolism studies conducted in citrus and maize were provided for evaluation. These indicate rapid and extensive metabolism of butafenacil with no significant component of the total radioactive residue (TRR) present in the crop. In animals, butafenacil was rapidly absorbed and eliminated. The metabolic pathways for butafenacil in plants and animals were broadly similar. Important transformations in plants and animals included hydrolysis of the ester moieties (allylic and substituted acetate), N-desmethylation, oxidation (addition of water to uracil ring), uracil ring opening, reduction (of uracil ring) and sugar conjugation.

The residue definition for monitoring Good Agricultural Practice should be butafenacil *per se*.

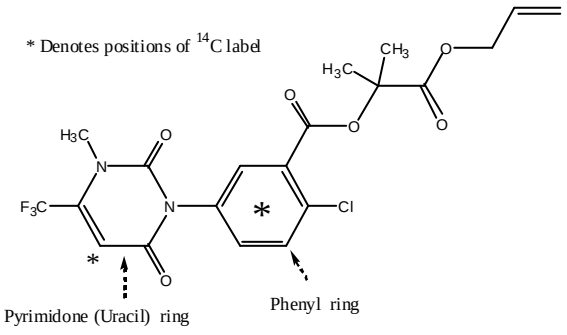
Residue data were provided for wheat, barley, oats and triticale. MRLs have been recommended to cover residues arising from the use of butafenacil when used according to Good Agricultural Practice.

Based upon predicted animal dietary burdens, MRLs have been recommended to cover residues of butafenacil in animal tissues and milk arising from livestock dietary exposure to butafenacil.

A chronic dietary risk assessment was performed for butafenacil residues in food. It is concluded that the establishment of MRLs to cover the use of butafenacil according to Good Agricultural Practice is unlikely to pose a significant risk to human health from a dietary intake perspective. The acute toxicology of butafenacil was considered by the Therapeutic Goods Administration (TGA) and an acute reference dose was not considered necessary. Acute dietary exposure to butafenacil is unlikely to pose a significant risk to human health.

Metabolism

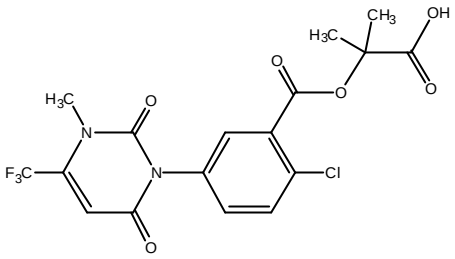
The applicant provided plant metabolism studies for butafenacil conducted on citrus and maize; and animal metabolism studies conducted on rats, laying hens and lactating goats.



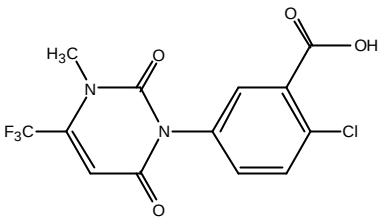
Butafenacil

Citrus, in controlled environment (climatically controlled greenhouse) was treated with [Phenyl-(U)-^{14}C]-butafenacil, applied to the soil at 200 and 2000 g ai/ha. The uptake of radioactivity was low, <1 % total radioactive dose (TRR) was found in leaves at all time intervals (132-350 days after treatment). Residue levels in fruit were even lower with <0.02% TRR found in fruit at harvest time. The majority of the TRR was found in the peel (63 %) and pulp (33%) and a trace in juice (3 %). Transformation of the parent butafenacil was extensive and it was not observed in the plant material. Major metabolic pathways include the hydrolysis of the allyl moiety to form the free acid metabolite (i) and its sugar conjugate.

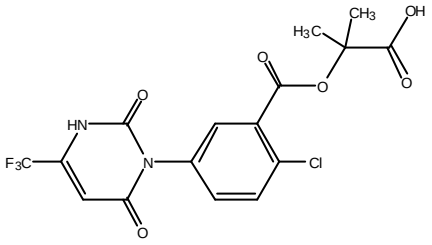
Subsequent metabolism, including further hydrolysis (removal of the substituted acetate moiety) to form the benzoic acid metabolite (ii) and sugar conjugate; N-desmethylation of the free acid metabolite and benzoic acid metabolite to form the corresponding N-desmethyl-free acid metabolite (iii) and N-desmethyl-benzoic acid metabolite (iv). Extractibility of the radioactive residue was acceptable, with less than 20 % of the TRR found as bound residues. Similar residue levels were found when using [Pyrimidine-5-^{14}C]-butafenacil labelled material, thus indicating the metabolic fate is independent of the label used.



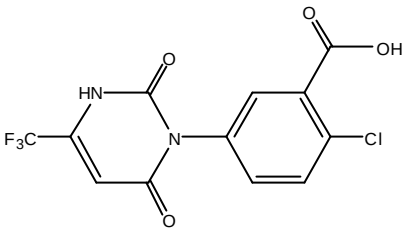
Free Acid Metabolite (i)



Benzoic Acid Metabolite (ii)



N-Desmethyl Free Acid Metabolite (iii)



N-Desmethyl Benzoic Acid Metabolite (iv)

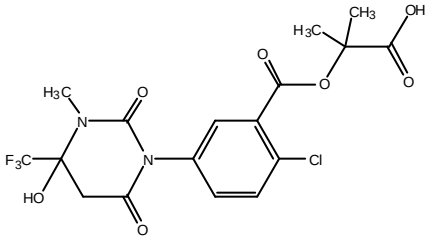
Maize under climatically controlled greenhouse conditions was treated with [Phenyl-(U)-^{14}C]-butafenacil at 200 and 400 g ai/ha, applied to the soil one day after planting. Severe phototoxicity was observed, however, plants recovered and grew to maturity. Samples were taken at 25 % maturity (forage, 35 days), 50 % maturity (silage, 72 days) and at harvest (111 days), consisting of grain and fodder (desiccated stalks and foliage). Total radioactive residues (TRR) was very low (<1 % of applied radioactivity at all sampling times). Extractibility was good, with bound residues generally less than 20 %. In silage, the level of radioactivity was extremely low, which did not allow for characterisation of the residual components. In fodder, the major metabolites identified were free acid metabolite (i) (maximum 8.4 %), benzoic acid metabolite (ii) (maximum 8.4 %), N-Desmethyl-free acid metabolite (iii) (maximum 13.1 %) and butafenacil (less than 0.5 %). An *in-vitro* study was also conducted which produced a host of conjugate metabolites, however, none of these were identified in the former plant extracts.

The proposed metabolic pathway from the target plant metabolism studies is similar. The routes of metabolism include hydrolysis of the ester functions (allyl and substituted acetate) to form the free acid metabolite (i) and benzoic acid metabolite (ii), respectively, along with sugar conjugation of these; N-Desmethylation of free acid metabolite and benzoic acid metabolite to form the N-desmethyl analogues, N-desmethyl free acid metabolite (iii) and N-desmethyl benzoic acid metabolite (iv), respectively.

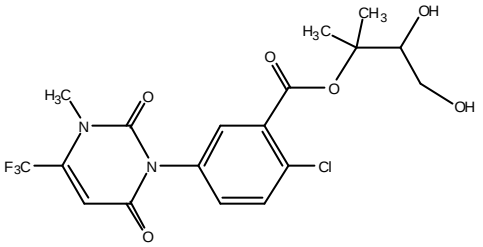
Rats were fed [Phenyl-(U)-^{14}C]-butafenacil at single dose levels of 0.5 or 100 mg/kg bw. Most of the radioactivity (>90 %) was excreted within 48 hours after administration, mostly via the faeces and small quantities in the urine (<15 %). Residues in selected tissues at both dose levels were low, with the highest levels found in bone and ovaries (<0.5 % of dose). In bile cannulated rats, which received a single oral dose of 0.5 mg/kg bw [Phenyl-(U)-^{14}C]-butafenacil, most of the radioactivity was excreted with the bile (>70 %) indicating good absorption of butafenacil in the GI tract (>80 %). Pre-treatment for 14 days with orally dosed butafenacil did not influence the kinetic parameters and there was no evidence for

bioaccumulation. In rats, the major metabolic pathways involve: hydrolysis of the allyl ester to form the free acid metabolite (i), subsequent reduction to form the reduced free acid metabolite (viii); hydroxylation to form the hydroxylated free acid metabolite (v); and uracil ring opening to form the ring cleavage free acid metabolite (vii).

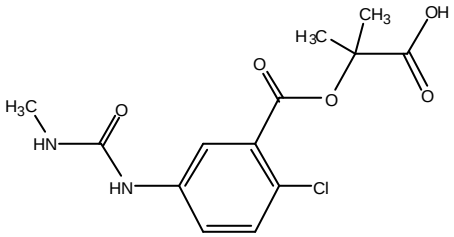
Lactating goats were dosed for four consecutive days at the rate equivalent to 100 ppm [Phenyl-(U)-^{14}C]-butafenacil in the diet. Excretion was primarily via the faeces (44 % of dose) and urine (12.5 % of dose). The remainder was recovered from the GI tract contents (23 %) and bile (0.3 %). The residual radioactivity in the edible tissues and milk accounted for less than 0.6 % of the dose. The highest ^{14}C tissue residues were found in the liver and kidney (4.4 and 0.4 mg equiv./kg, respectively). Characterisation of the residual radioactivity found in the tissues and milk showed extensive metabolism of butafenacil. The principal metabolite was free acid metabolite (i), accounting for approximately 85 % in the liver and kidney, along with smaller amounts of butafenacil, benzoic acid metabolite (ii), and various conjugates in the other tissues. The minor metabolic processes include the addition of water across the double bond of free acid metabolite to give the hydroxylated uracil analogue, hydroxylated free acid metabolite (v) and subsequent ring opening to form ring cleavage free acid metabolite (vii); and oxidation of the allyl moiety to form the glycerol-ester-conjugate-free acid metabolite (vi). Hydrolysis of the second ester (substituted acetate) to give the benzoic acid metabolite (ii) was only observed in the urine and faeces. Glucuronide conjugates of free acid metabolite were also observed. Cleavage or loss of the uracil ring was not observed in the milk or other tissues.



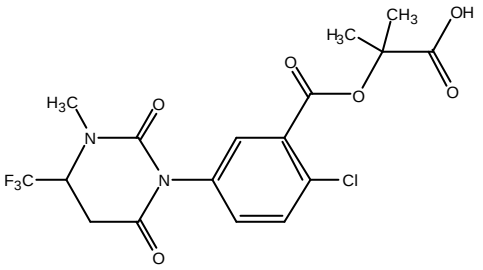
Hydroxylated free acid metabolite (v)



Glycerol ester conjugate- free acid metabolite (vi)



Ring cleavage free acid metabolite (vii)



Reduced free acid metabolite (viii)

Laying hens were dosed for eight consecutive days at a rate equivalent to 100 ppm [Phenyl-(U)-^{14}C]-butafenacil in the diet. The majority of the dose was recovered from the excreta (86 % of the dose), with traces recovered from the edible tissues (0.07 % of the dose) and egg white and yolk (<0.01% of the dose). Characterisation of the residual activity in edible tissues and eggs indicates metabolism is primarily via hydrolysis of the allyl ester of butafenacil to form free acid metabolite (i). Minor metabolic pathways include the hydrolysis of the second ester to form benzoic acid metabolite (ii); the addition of water across the uracil double bond to form hydroxylated free acid metabolite (v); N-desmethylation of free acid metabolite to form the analogue, N-desmethyl-free acid metabolite (iii). Comparison of hen and goat metabolism data shows that similar metabolic pathways processes are involved.

The metabolism of butafenacil in plants and animals is adequately understood.

No additional metabolism data were presented for glyphosate and triasulfuron. As the use patterns for these chemicals are well established, the metabolism of these chemicals is considered to be adequately understood.

Analytical Methodology

Analytical methodology for the determination of butafenacil and the benzoic acid metabolite (= CGA 293730) in commodities of plant and animal origin were provided.

Residues in cereal matrices (forage, fodder, straw) were performed by extraction with acidified methanol and clean up using C_{18} solid phase extraction (SPE) and Envicarb SPE cartridge combination. Butafenacil and the benzoic acid metabolite are determined by HPLC-UV with external standard calibration. Acceptable recoveries were demonstrated, with a limit of quantification (LOQ) for both compounds of 0.01 mg/kg wet weight forage (equivalent to 0.07 mg/kg dry weight), and 0.02 mg/kg dry weight for straw and grain.

Methodology was provided for the determination of butafenacil and the benzoic acid metabolite in animal tissues. Representative samples are homogenised with acidified acetonitrile and partitioned with hexane before recovery of the acetonitrile fraction. After evaporation of the solvent, the residue is cleaned-up using C_{18} SPE and Envicarb SPE cartridge combination. Butafenacil and benzoic acid metabolite are determined by HPLC-UV with external standard calibration. Acceptable recoveries were demonstrated for various tissues, eggs and milk. The LOQ for both compounds in milk, meat and eggs was 0.01 mg/kg. In fat, liver and kidney, the LOQ was 0.02 mg/kg.

Storage stability

Samples of forage, straw and grain were stored frozen for a maximum of 3 months prior to analysis. Storage stability data were provided for various plant commodities (orange, apple, olive, potato, maize). The data indicate that residues in plant commodities do not degrade significantly after 24 months of frozen storage (-18 °C). Metabolism studies performed on goat and hen indicate that frozen samples (including liver, fat, kidney and urine) showed minimal deterioration after 6 months storage. The results obtained in the residue trials are considered an accurate reflection of the residues present in the samples at the time of collection.

Residue Definition

No change to the current residue definitions for glyphosate and triasulfuron are required. The residue definitions should remain as parent compound *per se.*

The metabolism studies indicate butafenacil is rapidly metabolised in plants and animals. The benzoic acid metabolite (= CGA 293730) was observed in citrus and maize at up to 11 % of the TRR. Analytical methodology for separate determination of butafenacil and the benzoic acid metabolite were provided. In residue field studies conducted at exaggerated application rates, neither butafenacil nor the benzoic acid metabolite were observed above the LOQ in grain, forage or straw. The residue definition should be as follows:

Butafenacil butafenacil

Residue Trials

No additional residue data were provided for glyphosate and triasulfuron. The proposed use-pattern for these chemicals are within currently registered use-patterns. Accordingly, no change to the *MRL Standard* is necessary.

The applicant provided residue trial data from trial evaluation studies conducted in Australia for *TOUCHDOWN B-POWER HERBICIDE* and *LOGRAN B-POWER HERBICIDE* measuring the level of butafenacil residues when the products are used according to the proposed use-pattern on wheat, barley, oats and triticale.

Wheat
Ten residue trials were conducted in Australia on wheat. The trials measured the level of butafenacil residues in wheat when treatment was applied one day before sowing the crop. The data consistently shows that in all cases, residue levels of butafenacil are below the Limit of Quantification (LOQ) of 0.02 mg/kg.

Barley
Five residue trials were conducted in Australia on barley. The trials measured the level of butafenacil residues in barley when treatment was applied one day before sowing the crop. The data consistently shows that in all cases, residue levels of butafenacil are below the Limit of Quantification (LOQ) of 0.02 mg/kg.

Oats
Three residue trials were conducted in Australia on oats. The trials measured the level of butafenacil residues in oats when treatment was applied one day before sowing the crop. The data consistently shows that in all cases, residue levels of butafenacil are below the Limit of Quantification (LOQ) of 0.02 mg/kg.

Triticale
Three residue trials were conducted in Australia on triticale. The trials measured the level of butafenacil residues in triticale when treatment was applied one day before sowing the crop. The data consistently shows that in all cases, residue levels of butafenacil are below the Limit of Quantification (LOQ) of 0.02 mg/kg.

The following MRL is required to cover the proposed use of the products:

Cereal grains (except rice)	*0.02 mg/kg

Animal Commodity MRLs
The applicant proposed a grazing withholding period of 6 weeks and 7 weeks, respectively, for *TOUCHDOWN B-POWER HERBICIDE* and *LOGRAN B-POWER HERBICIDE*. The earliest sampling for determination of butafenacil residues in forage was at 6 weeks after application. Residues were <0.01 mg/kg wet weight (<0.07 mg/kg dry weight) in all samples taken 6 weeks after application. A grazing WHP of 7 weeks was proposed for *LOGRAN B-POWER HERBICIDE* due to the presence of triasulfuron in the product. A 7 week grazing WHP is consistent with the registered use pattern of *Logran 750 WP Herbicide* (containing 750 g/kg of triasulfuron).

Residues in cereal straw were <0.02 mg/kg dry weight in all samples collected at harvest. The following animal feed commodity MRLs are required:

Forage of cereal grains (except rice)	*0.1 mg/kg
Straw and fodder of cereal grains (except rice)	*0.02 mg/kg

In a goat metabolism study, the total radioactive residues were the highest in liver (4.4 mg equivalent/kg) following dosing at 100 ppm in the diet. If forage containing butafenacil at the MRL (0.1 mg/kg) was consumed as the entire cattle diet, then residues in all tissues and milk would be <0.001 mg equiv./kg. It is appropriate to recommend animal commodity MRLs at the limits of analytical determination.

The following MRLs are appropriate with respect to mammalian meat commodities:

Offal, mammalian	*0.02 mg/kg
Meat, mammalian	*0.01 mg/kg
Milk	*0.01 mg/kg

In hens dosed at 100 ppm in the diet, total radioactive residues were also the highest in the liver (ie 0.52 mg equiv./kg). If grain containing butafenacil at the MRL (0.02 mg/kg) was consumed as the entire diet, then residues in all poultry tissue (meat, offal) and eggs would be <0.001 mg equiv./kg. It is appropriate to recommend animal commodity MRLs at the limits of analytical determination. The following MRLs are appropriate with respect to poultry commodities:

Poultry Eggs	*0.01 mg/kg
Poultry offal	*0.02 mg/kg
Poultry meat	*0.01 mg/kg

Recommended Amendments to the *MRL Standard*

Table 1

Compound	Food			MRL (mg/kg)
DELETE:				
Butafenacil				
	GC	0080	Cereal grains (except maize, sorghum, millet and rice)	T*0.02
	MO	0105	Edible offal [mammalian]	T*0.02
	PE	0112	Eggs	T*0.01
	MM	0095	Meat [mammalian]	T*0.01
	ML	0106	Milks	T*0.01
	PO	0111	Poultry, Edible offal of	T*0.02
	PM	0110	Poultry meat	T*0.01
ADD:				
Butafenacil	GC	0080	Cereal grains (except rice)	*0.02
	MO	0105	Edible offal [mammalian]	*0.02
	PE	0112	Eggs	*0.01
	MM	0095	Meat [mammalian]	*0.01
	ML	0106	Milks	*0.01
	PO	0111	Poultry, Edible offal of	*0.02
	PM	0110	Poultry meat	*0.01

Table 4

Compound	Animal feed commodity			MRL (mg/kg)
DELETE:				
Butafenacil			Forage of cereal grains	T*0.02
	AS	0081	Straw and fodder (dry) of cereal grair	T*0.02
ADD:				
Butafenacil			Forage of cereal grains (dry) [except rice]	*0.1
	AS	0081	Straw and fodder (dry) of cereal grains [except rice]	*0.02

Withholding Periods

The following withholding periods are required in conjunction with the above MRLs:

TOUCHDOWN B-POWER HERBICIDE

Cereal grains (except rice)

Grazing: DO NOT Graze or Cut For Stock Food For 6 Weeks After Application

Harvest: Not required when the product is used as directed.

LOGRAN B-POWER HERBICIDE

Wheat

Grazing: DO NOT Graze or Cut For Stock Food For 7 Weeks After Application

Harvest: Not required when the product is used as directed.

Dietary Risk Assessment

The chronic dietary risk is estimated by the National Estimated Daily Intake (NEDI) calculation encompassing all registered/temporary uses of the chemical and dietary intake data from the 1995 National Nutrition Survey of Australia. The NEDI calculation is made in accordance with the Guidelines for predicting dietary intake of pesticide residues (revised) (World Health Organisation, 1997).

The NEDI of butafenacil is equivalent to 4 % of the ADI. In addition, the DIAMOND calculation gives an intake of 5 % of the ADI. It is concluded that the chronic dietary exposure is small and the risk is acceptable.

The acute toxicology of butafenacil was considered by the Therapeutic Goods Administration (TGA) and an acute reference dose was not considered necessary. Acute dietary exposure to butafenacil is unlikely to pose a significant risk to human health.

Conclusion

The NRA is satisfied that the proposed use of *LOGRAN B-POWER HERBICIDE* and *TOUCHDOWN B-POWER HERBICIDE* will not be an undue hazard to the safety of people consuming anything containing their residues. Maximum Residue Limits (MRLs) have been proposed for butafenacil (including MRLs for animal feed commodities), and Withholding Periods proposed for *LOGRAN B-POWER HERBICIDE* and *TOUCHDOWN B-POWER HERBICIDE* when used in wheat and cereals respectively.

Assessment of Overseas Trade Aspects of Residues in Food

Commodities Exported and Main Destinations

The Australian wheat production in 1999-00 was 25, 000 kilo tonnes with export of 17,274 kilo tonnes (estimated value $m 3,481). The main destinations for export are the Middle East countries, Pakistan, Japan, Korea, Indonesia, Egypt and Oceania (Fiji, New Zealand, Papua New Guinea) [Australian Commodity Statistics, 2000]. The applicant indicates barley is exported to Japan and Saudi Arabia. Malting barley is exported to China, Taiwan, Korea and Japan. Oats are exported to Japan, EU, and other opportunistic markets. Oaten hay is exported to Japan. Triticale is currently not exported.

Overseas Registration Status

Products containing butafenacil are registered in Argentina, Switzerland, Japan, Thailand and under permit in Brazil. The use-pattern in these countries is for total vegetation management (TVM) under orchard trees (citrus, pome, stone fruit, grape, and tropical fruit trees). In Japan, butafenacil is also for TVM on rice paddy field levees. In Thailand, butafenacil is used for fallow weed control prior to planting garlic, onions and shallots. The application rates for these situations are generally higher, up to 100 – 200 g ai/ha, and in all circumstances, the local MRL will be set at the detection limit, ie 0.02 mg/kg of butafenacil.

CODEX Alimentarius Commission MRL

Butafenacil has not been considered by Codex and there are no Codex MRLs established.

Potential Risk to Australian Export Trade

Based upon the proposed use-pattern and residue data that indicates butafenacil residues in grain, forage and straw will be "at or about" the LOQ of 0.02 mg/kg, the proposed uses of *TOUCHDOWN B-POWER HERBICIDE* and *LOGRAN B-POWER HERBICIDE* are unlikely to unduly prejudice trade.

OCCUPATIONAL HEALTH AND SAFETY ASSESSMENT

NOHSC has conducted a risk assessment on *LOGRAN B-POWER HERBICIDE* containing butafenacil and triasulfuron at 200 g/kg and 520 g/kg, respectively, as a water dispersible granule formulation and *TOUCHDOWN B-POWER HERBICIDE* containing butafenacil and glyphosate at 5 g/L and 225 g/L, respectively, as a suspension concentrate formulation. Butafenacil is a new technical grade active constituent. The two products can be safely used by workers when handled in accordance with the control measures indicated in this assessment.

LOGRAN B-POWER HERBICIDE and *TOUCHDOWN B-POWER HERBICIDE* are indicated for the control of various weeds prior to planting wheat and cereal crops, respectively. The products will be applied by ground application using boom spray equipment at the maximum application rate of 50 g/ha (*LOGRAN B-POWER HERBICIDE*) and 3.2 L/ha (*TOUCHDOWN B-POWER HERBICIDE*) in a minimum spray volume of 50 L/ha water. They will be applied for 1-5 days/year with one application per crop per season.

The new active ingredient, butafenacil, has low acute oral, dermal and inhalation toxicity in rats. It is a slight eye irritant but not a skin irritant in rabbits. Butafenacil is not a skin sensitiser in guinea pigs.

Butafenacil is not on the NOHSC *List of Designated Hazardous Substances* and is classified as non-hazardous, according to NOHSC *Approved Criteria for Classifying Hazardous Substances*. Both the products *LOGRAN B-POWER HERBICIDE* and *TOUCHDOWN B-POWER HERBICIDE* are not classified as hazardous.

Both products are likely to be of low acute oral, dermal and inhalation toxicity and slight eye and skin irritants but not skin sensitisers.

Based on the supplied use pattern information, the risk assessment indicated that personal protective equipment (elbow-length PVC or rubber gloves) is needed for workers when opening the container and preparing spray.

Formulation, Repackaging, Transport, Storage and Retailing

LOGRAN B-POWER HERBICIDE will be formulated overseas and imported fully packed in 1, 1.5 and 2 kg high-density polyethylene (HDPE) bottles, which are ready-to-use. Transport workers, store persons, and retailers will handle the packaged products and could only become contaminated if packaging were breached.

TOUCHDOWN B-POWER HERBICIDE will be formulated in Australia and will be packed in 20 L HDPE drums with twin neck (neck size of 58 mm) and in 90 L, 100 L and 110 L returnable HDPE containers. The applicant has stated that operators engaged in formulation are required to wear protective clothing and personal protective equipment.

Advice on safe handling of the active constituent or the products during routine use is provided in the Material Safety Data Sheet (MSDS) for the respective products.

Use and exposure

LOGRAN B-POWER HERBICIDE is indicated for burn down, pre-emergent and residual control of various weeds prior to planting wheat. It will be applied by tractor mounted ground boom sprayers. The maximum application rate is 50 g/ha, with a minimum spray volume of 50 L/ha. The product could be applied once per crop season or up to twice a year.

TOUCHDOWN B-POWER HERBICIDE is indicated for the control of various weeds prior to planting cereal crops. *TOUCHDOWN B-POWER HERBICIDE* will be applied by ground application using boom spray equipment at the maximum application rate of 3.2 L/ha in a minimum spray volume of 50 L/ha water. *TOUCHDOWN B-POWER HERBICIDE* will be applied for 1-5 days/year with one application per crop per year.

Categories of workers that can be potentially exposed to the products are mixer/loaders, ground applicators, clean-up personnel and re-entry workers. The main routes of exposure will be dermal and ocular, though inhalation exposure to product and spray mist can also occur.

Both products have low acute oral and dermal toxicity and are slight skin and eye irritants but not skin sensitisers. Therefore, based on acute toxic potential, skin and eye protection is not needed for the users of these products and hazard statements for skin and eye protection should be enough.

Worker exposure studies on butafenacil or the two products are not available. Therefore, NOHSC used UK Predictive Operator Exposure Model to estimate mixer/loader/applicator exposure to these products.

The risk assessment, which took acute and repeat dose toxicities into consideration, indicated that personal protective equipment is needed to prevent exposure to the product. In particular, elbow-length PVC or rubber gloves, should be worn when opening the container and preparing spray.

Recommendations for Safe Use

Users should follow the instructions and Safety Directions on the product label.
Safety Directions include the use of elbow-length PVC or rubber gloves when preparing the spray.

The personal protective equipment recommended should meet the relevant *Standards-Australia* criteria.

Re-entry Statement

A restricted re-entry statement, for either product, is not required.

Information Provision

Syngenta Crop Protection Pty Limited has produced MSDS for *LOGRAN B-POWER HERBICIDE* and *TOUCHDOWN B-POWER HERBICIDE*. The MSDS contain information relevant to Australian workers, as outlined in the *NOHSC National Code of Practice for the Preparation of MSDS*. Employers should obtain the MSDS from the supplier and ensure that their employees have ready access to it.

Conclusion

LOGRAN B-POWER HERBICIDE and *TOUCHDOWN B-POWER HERBICIDE* can be used safely if handled in accordance with the instructions on the product label. Additional information is available in the MSDS for the respective products.

ENVIRONMENTAL ASSESSMENT

Environmental Aspects

The environmental hazard of butafenacil will be highest to organisms living in the vicinity of where it will be applied. Residues from application would be expected on plant surfaces and soil. Surface water, uncultivated land and nearby non-target plants (e.g. trees and grasses) may be contaminated through overspray, spray drift and/or run-off.

Butafenacil is not expected to hydrolyse significantly at acid to neutral environmental pHs but has a relatively quick half-life at pH 9. Aqueous photolysis is relatively slow. The estimated half-life of butafenacil in the atmosphere by hydroxyl radical oxidation was 3-4.5 h. Microbial biodegradation is rapid in aerobic soils with a DT50 of 0.5-2.2 d with major metabolites (appearing in order) of CGA 293731, CGA 293730 and CGA 380963. Mineralisation to CO_2 was also rapid with up to 64% conversion at 120 DAT. Biodegradation in waterlogged anaerobic conditions was relatively quick with a DT50 of 1.9-3.4 d. However, mineralisation to CO_2 was much slower with trifluroacetone as the major volatile product. Biodegradation of butafenacil from the water phase of natural river and pond systems was generally quicker than from the sediment phase with entire system DT50 values of 3.7-6.1 d. When these systems were made anaerobic, the butafenacil DT50 was 4.0 d but the major metabolite CGA 98166 was persistent with a DT50 >1,000 d.

The K_{OC} values for butafenacil were 149-581 mL/g in four soils which spans from low to high mobility, while the metabolites CGA 293731, CGA 293730, CGA 380963 and CGA 98166 were highly to very highly mobile. Most parent butafenacil (≥80%) remained in the top 15 cm of various soils with only ≤1% in the leachate of the 30 cm soil columns, except for the loamy sand where 7.7% as CGA 293731 leached through the column. When aged residues were leached, 69-94% of the applied radioactivity appeared in the leachate with CGA 293730 accounting for 55-78% and CGA 380963 accounting for 11-13%; no parent was found in any of the leachates. Butafenacil did not volatilise from moist soil surfaces as losses were <3.3% over 24 h. In worst case scenarios where three applications of 250/900 g/ha butafenacil/glyphosate were made to bare soils 35-58 d apart, a maximum of 0.16 mg a.i./kg soil of butafenacil was detected 1 d after the second application in the top 10 cm of soil. Minor residues of parent and metabolites were detected in soil layers down to 90 cm depth within 91 d after the third application. Butafenacil was rapidly concentrated in bluegill sunfish with a peak bioconcentration factor of 122. Greater than 98% of the absorbed dose was eliminated within 14 d after transfer to clean water.

Butafenacil was practically nontoxic to adult mallard ducks and bobwhite quail in single oral dose and 5-d dietary exposures. In one generation dietary exposures with mallards and quail, the highest concentration tested of 674 mg a.i./kg food had no adverse effect. Butafenacil was moderately toxic to rainbow trout, bluegill sunfish and sheepshead minnow in 96-h acute tests and to early life stages of trout in a chronic 88-d exposure, with a high acute to chronic ratio. The two TGACs formulated together produced a 96-h LC50 between 2.5/9.0 and 4.8/16.9 mg/L butafenacil/glyphosate to trout while the metabolites were all at worst only slightly toxic. *Daphnia magna* were moderately sensitive to technical grade butafenacil but highly sensitive when it was formulated alone or in conjunction with glyphosate. The technical grade was also highly toxic to marine mysid shrimp and moderately toxic to the eastern oyster. Major metabolites were at worst slightly toxic to daphnids. However, daphnids were highly sensitive to butafenacil in chronic tests giving a high acute to chronic ratio. Algae and aquatic macrophytes were generally very highly sensitive with a marine diatom being the most acutely sensitive. The main metabolites most similar to parent butafenacil retained their herbicidal activity (still highly toxic) which declined to practically nontoxic as structural similarity was lost.

Earthworms were not sensitive to butafenacil or certain metabolites while honeybees were not sensitive to technical or formulated butafenacil/glyphosate. Butafenacil formulated alone or with glyphosate was harmless to carabid beetles and rove beetles and parasitic wasps also showed no effect to butafenacil. However, predatory bugs and mites experienced 100% mortality after 7-9 d when exposed to 250 g a.i./ha and 10.5/36.2 g/ha butafenacil/glyphosate, respectively. Soil respiration and nitrification processes were not adversely by up to 1.67 mg a.i./kg soil dw. Terrestrial plants were extremely sensitive with cucumber seedlings adversely affected by 0.036 g a.i./ha.

The proposed use patterns of *TOUCHDOWN B-POWER HERBICIDE* and *LOGRAN B-POWER HERBICIDE*s on wheat and other cereals are expected to result in exposure to nontarget organisms. However, due to the low maximum application rate of 40 g a.i./ha only once per year and the relatively low toxicity of butafenacil and its major metabolites to these organisms, the acute and chronic hazard to birds, earthworms, honeybees, carabid beetles, rove beetles, parasitic wasps and soil microoorganism respiration and nitrogen mineralisation processes is expected to be low.

The label for *TOUCHDOWN B-POWER HERBICIDE* prohibits application within 20 m of natural or impounded lakes or dams. This should be sufficiently protective to lead to an acceptable hazard from spraydrift from both butafenacil and glyphosate. However, to provide an adequate safety margin for algae and aquatic macrophytes from spray drift from triasulfuron in *LOGRAN B-POWER HERBICIDE*, the company has agreed that the statement should be expanded to a buffer zone of 50 m and include all other waterways. Calculations show the hazard from run-off will be mitigated by banning application if heavy rainfall is forecast within 6 or 48 h and observing buffer zones of 20 and 50 m for *TOUCHDOWN B-POWER HERBICIDE* and *LOGRAN B-POWER HERBICIDE* respectively.

The acute hazard to predatory bugs is unknown while that to terrestrial plants and predatory mites is unacceptable. Although the use pattern of the products should reduce the exposure to predatory bugs and mites, any impact on their populations should be compensated by rapid recovery. While the labels for both products include some prohibition for allowing spray to drift onto some other plants, they should be amended to prohibit application that may affect all non-target plants.

Environmental Exposure

LOGRAN B-POWER HERBICIDE is a quick-acting knockdown herbicide with residual activity. It will be used as a pre-plant knockdown prior to the planting of wheat, with the triasulfuron component providing residual weed control in the crop. Application will be mostly to dryland broadacre cereal cropping in the southern and western Australian wheatbelt. The product is not expected to be used in irrigation cropping since the triasulfuron component is not suitable to double cropping.

Spraying will be by low boom sprayer (mostly tractor mounted) using flat fan nozzles and water volumes of 50-100 L/ha at an application rate of 10 g a.i./ha for butafenacil and 26 g a.i./ha for triasulfuron. (The maximum application rate of triasulfuron in other products registered for use in wheat is 25 g a.i./ha.) From the volume of spray solution, medium to coarse droplets are expected which would have limited spray drift potential. The company has agreed to explicitly state on the label that both products should not be applied by aircraft. Only one application per year will be permitted. Application will be to moist soils prior to planting the wheat crop in April to June when air temperatures will be about 10-20°C. The mild weather experienced at that time of the year is unlikely to favour drift. Rainfall after application may be heavy at that time of the year potentially leading to run-off.

TOUCHDOWN B-POWER HERBICIDE is a systemic non-selective herbicide absorbed by plant foliage and green stems before translocation to the roots. It controls emerged weeds only that are actively growing at the time of treatment and have at least one true leaf (broadleaf weeds) or two leaves (grasses) to provide an adequate surface area for uptake. It will be used prior to sowing a cereal crop and to commence a fallow in the same areas as *LOGRAN B-POWER HERBICIDE*.

The maximum application rate of *TOUCHDOWN B-POWER HERBICIDE* is 40 g a.i./ha for butafenacil and 1,800 g a.i./ha for glyphosate. The maximum application rate of glyphosate (isopropylamine salt) in non-crop situations in Australia is 3 kg a.i./ha which is well above the application rate of glyphosate in *TOUCHDOWN B-POWER HERBICIDE*. However, in wheat and cereals, the maximum rate of currently registered products (using the same salt) is 540 g a.i./ha.

Environmental Chemistry and Fate

Abiotic Transformation

Butafenacil is not expected to hydrolyse significantly at acid to neutral environmental pHs. However, hydrolysis is relatively quick at pH 9 with a half-life of 1.3-2.6 d at 20°C. Major transformation products include CGA 293730, CGA 293731 (both acids) and CGA 374234. Aqueous photolysis is relatively slow with a half-life of 25-30 d in measured experiments. On sandy loam thin layers, degradation was quick with a DT50 of 0.61-0.80 d but this was attributed to microbial biodegradation since the DT50 in dark controls was 0.67-0.83 d. Under Australian conditions, the DT50 from direct photolysis in aqueous solution was estimated at 164-421 d. The estimated half-life of butafenacil in the atmosphere by hydroxyl radical oxidation was 3-4.5 h.

Biotic Transformation

Microbial biodegradation is rapid in aerobic soils with DT50 and DT90 values of 0.5-2.2 and 1.8-7.3 d in three studies on a total of six soils. The major metabolites appearing in order were the acids CGA 293731, CGA 293730 and the reduced acid CGA 380963. Mineralisation to CO_2 was also rapid with up to 64% conversion at 120 DAT. Metabolism was about twice as fast at 60% soil moisture than at 30%. The DT50 values for the metabolites CGA 293731, CGA 293730 and CGA 380963 were 1.6-4.3, 3.1-38.7 and 3.4-53.8 d, which are considered nonpersistent, slightly and moderately persistent, respectively, in the worst case.

The biodegradation of butafenacil in waterlogged anaerobic conditions was relatively quick with a DT50 of 1.9-3.4 d in two systems. However, the ultimate metabolism to CO_2 was much slower with only 0.3% converted at 180 DAT. The DT50 values for CGA 293731 and CGA 293730 were also slower at 27 and 21 d, respectively. The uracil ring opened acid metabolite CGA 368221 peaked at 23% at 28 DAT while the related acid CGA 98166 continuously rose reaching 84% at the end of the study. Trifluroacetone was the major volatile product detected at 60% at 182 DAT. Other major metabolites included CGA 368220 and but-2-enoic acid.

The decrease of radioactivity in the water of both the river and pond aerobic systems was biphasic with a rapid initial decrease followed by a lag phase of slower disappearance. Biodegradation times for parent butafenacil were generally rapid with quicker dissipation from the water phase than sediment with entire system DT50 values of 3.7-6.1 d. When these systems were made anaerobic, the parent butafenacil DT50 was 4.0 d but the major metabolite CGA 98166 was persistent with a DT50 >1,000 d. These values were confirmed by computer modelling which predicted whole system DT50 values of 3.1-13 d for butafenacil and 23-73 d for CGA 293731, 13-136 d for CGA 293730, 13-98 d for CGA 368221 and 35-45 d for CGA 98166.

The K_{OC} values for butafenacil were 149-581 mL/g in four soils which spans from low to high mobility. The metabolites CGA 293731, CGA 293730, CGA 380963 and CGA 98166 were very highly mobile in the same soils with all K_{OC} values <50 mL/g except for CGA 293731 in the sand soil at 55 mL/g which was highly mobile. Leaching experiments showed most parent compound (≥80%) remained in the top 15 cm of various soils with only ≤1% in the leachate of the 30 cm soil columns. The only exception was the loamy sand where 7.7% as CGA 293731 leached through the column. The penetration depth of parent butafenacil into the soil profile was up to 30 cm for all soils investigated. When aged residues were leached with 200 mm of water, 69-94% of the applied radioactivity appeared in the leachate with CGA 293730 accounting for 55-78% and CGA 380963 accounting for 11-13%; no parent was found in any of the leachates. Computer modelling confirmed these findings of no parent leaching below the root zone in orchards and winter wheat with a worst case leaching of 0.20 and 1.5 µg/L predicted for CGA 293730 and CGA 380963, respectively, in Geraldton's coarse sandy soil with its low organic carbon. Butafenacil did not volatilise from moist soil surfaces as losses were <3.3% over 24 h.

Field Dissipation

In worst case scenarios where a butafenacil + glyphosate formulation was applied three times (35-58 d interval) to bare orchard soils at 250/900 g/ha butafenacil/glyphosate, a maximum of 0.16 mg a.i./kg soil of butafenacil was detected 1 d after the second application in the top 10 cm of soil. Residues of parent and CGA 293731 declined to <0.01 mg/kg in all soil layers down to 90 cm depth within 91 d after the third application. In one orchard, CGA 293730 also disappeared within this time, while in the other trial, it was detectable at 0.01-0.03 mg/kg in the 10-30 cm soil layer 88 d after the final treatment. CGA 380963 was measured at 0.01-0.05 mg/kg in the 0-50 cm soil layer at 91 d after the last application in both orchards.

Bioconcentration

Butafenacil was rapidly concentrated in both edible and non-edible parts of bluegill sunfish, peaking after 7 d at 0.15 and 3.3 mg equivalents/kg tissue, respectively, when exposed to a concentration of 0.03 mg a.i./L. The highest bioconcentration factor was 122 which indicates low to moderate bioconcentration potential. After 19 d, butafenacil was metabolised to CGA 293731. Greater than 95% of the absorbed dose was eliminated within 6 d and >98% within 14 d after transfer to clean water.

Environmental Toxicology for Butafenacil

Birds

Butafenacil was practically nontoxic to adult mallard ducks and bobwhite quail in single oral dose exposures with the LD50 > 2,250 mg a.i./kg bw. This was also seen in 5-d dietary exposures for mallards and quail with the LC50 > 5,590 mg a.i./kg food but quails had a slight treatment related decrease in body weight and food consumption giving NOEC and LOEC values of 3,080 and 5,590 mg a.i./kg bw, respectively. In one generation dietary exposures with mallards and quail, the NOEC was the highest concentration tested of 674 mg a.i./kg food as no effects were observed on any toxicological or reproductive parameters.

Fish

Butafenacil was moderately toxic to rainbow trout, bluegill sunfish and sheepshead minnow in 96-h toxicity tests with LC50 values of 3.9 (3.5, 4.4), >9.3 and 4.6 (4.4, 5.1) mg a.i./L, respectively. When formulated as an emulsifiable concentrate, butafenacil was still moderately toxic to trout with a 96-h LC50 between 4.9 and 9.5 mg a.i./L. The two TGACs formulated together produced a 96-h LC50 between 2.5/9.0 and 4.8/16.9 mg/L butafenacil/glyphosate to trout. The metabolites CGA 293731, CGA 293730, CGA 98166 and CGA 380963 were all at worst only slightly toxic with 96-h LC50 values of >86 mg/L.

In a chronic 88-d exposure to early life stages of trout, butafenacil was moderately toxic with NOEC and LOEC values of 11 and 22 µg a.i./L, respectively, based on larval survival, time to swim-up and reduced growth; the maximum acceptable toxicant concentration was 15.6 µg a.i./L. The acute to chronic ratio (ACR) was high at 250 (calculated as LC50/MATC).

Aquatic Invertebrates

Technical grade butafenacil was only moderately toxic to *Daphnia magna* with a 48-h EC50 of >8.6 mg a.i./L. However, when formulated as an emulsifiable concentrate, the 48-h EC50 was 0.64 (0.56, 0.74) mg a.i./L which was highly toxic. This was confirmed by the 48-h EC50 of 0.82/2.9 (0.71/2.5, 0.95/3.4) mg/L butafenacil/glyphosate when a formulation of both TGACs was used. The technical grade was also highly toxic to marine mysid shrimp (96-h EC50 = 0.12 (0.10, 0.14) mg a.i./L) and moderately toxic to the eastern oyster with a 96-h EC50 of 2.7 (2.5, 2.9) mg a.i./L based on inhibition of shell growth. The major metabolites (CGA 293731, CGA 293730, CGA 380963 and CGA 98166) were at worst slightly toxic to daphnids with 48-h EC50 values of >91.5 mg/L. Chronic exposures showed daphnids were highly sensitive to butafenacil with NOEC and LOEC values of 9 and 18 µg a.i./L. Given a MATC of 12.7 µg a.i./L, the ACR was high at >677.

Aquatic Plants

Technical grade butafenacil was moderately toxic to the blue-green alga *Anabaena flos-aquae* and very highly toxic to the freshwater diatom *Navicula pelliculosa*, green algae *Selenastrum capricornutum* and *Scenedesmus subspicatus* and marine diatom *Skeletonema costatum*, with the most sensitive 120-h EC50 of 0.11 (0.11, 0.12) µg a.i./L to the latter. When formulated as an emulsifiable concentrate, butafenacil was very highly toxic to *S. capricornutum* with a 72-h EC50 of 0.64 (0.38, 0.83) µg a.i./L. However, when butafenacil and glyphosate were tested with this alga, the E_bC50 was higher at 2.3/8.0 (2.0/6.9, 3.7/13) µg/L butafenacil/glyphosate.

The lowest 72-h E_bC50 of 0.17 mg/L for the metabolite CGA 293731 to *S. subspicatus* and *S. capricornutum* was two to three orders of magnitude higher than for parent butafenacil, but still considered highly toxic. The metabolite CGA 293730 was highly toxic to the former but only slightly toxic to the latter alga while CGA 380963 was practically nontoxic to *S. capricornutum* and CGA 98166 was slightly toxic to *S. capricornutum* and practically nontoxic to *S. subspicatus* over 72 h.

Butafenacil was very highly toxic to duckweed with a 14-d EC50 of 11 (8.7, 13) µg a.i./L based on frond production.

Terrestrial Invertebrates

Earthworms were not sensitive to parent butafenacil or the metabolites CGA 293730 or CGA 380963 with 14-d NOEC or LC50 values of >1,000 mg/kg soil dry weight. Honeybees were similarly nonsensitive with 48-h oral and contact LD50 values of >20 µg a.i./bee for technical and formulated butafenacil. The joint formulation was also at worst slightly toxic with 48-h oral and contact LD50 values of >21/72.4 µg/L butafenacil/glyphosate. Butafenacil formulated alone or with glyphosate was harmless to carabid beetles at 250 g a.i./ha or 262.5/905 g/ha butafenacil/glyphosate, respectively, over 14 d as no mortalities or adverse behavioural effects were observed. Rove beetles (over 75 d) and parasitic wasps (over 15 d) also showed no effect to butafenacil at 250 g a.i./ha. However, the predatory bug *Orius laevigatus* experienced 100% mortality after 9 d when exposed to 250 g a.i./ha while predatory mites (*Typhlodromus pyri*) experienced the same fate after 7 d at 10.5/36.2 g/ha butafenacil/glyphosate.

Soil Microorganism Processes

Respiration and nitrification processes were not adversely affected in the long term by butafenacil concentrations of 0.67 and 1.67 mg a.i./kg soil dry weight (corresponding to about

500 and 1,250 g a.i./ha, respectively) as deviations from controls were ≤25% by 28 DAT. The 3-h EC50 for respiration rate of activated sludge was >100 mg a.i./L.

Environmental Toxicology for Triasulfuron

Triasulfuron was only very slightly toxic to fathead minnows and *Daphnia magna* with NOEC values ≥10.3 mg a.i./L. However, it was very highly toxic to duckweed with a 14-d EC50 of 0.068 (0.061, 0.077) µg a.i./L. Triasulfuron metabolites CGA 195660 and CGA 150829 were moderately toxic (7-d E_bC50 = 4.2 (1.3, 6.8) mg/L) and very slightly toxic (7-d E_bC50 > 100 mg/L) to duckweed, respectively. Honeybees were insensitve to triasulfuron with 48-h contact and oral LD50 values >100 µg a.i./bee. Similarly, the 3-h IC50 to activated sludge was >100 mg a.i./L. An application rate of 160 g a.i./ha caused severe adverse effects after three weeks to a range of crop seedlings with lettuce being the most sensitive.

Environmental Hazard

The environmental hazard of butafenacil will be highest to organisms living in the vicinity of where it will be applied. Residues from application would be expected on plant surfaces and soil. Surface water, uncultivated land and nearby non-target plants (e.g. trees and grasses) may be contaminated through overspray, spray drift and/or run-off.

Expected Environmental Concentrations

Concentration in soil

The maximum application rate of *LOGRAN B-POWER HERBICIDE* would correspond to 10 g a.i./ha for butafenacil and 26 g a.i./ha for triasulfuron only once per year. Given a direct application to bare soil at the maximum rate, incorporation into the top 15 cm (≥80% of butafenacil remained in the top 15 cm of soils in leaching experiments) and a soil bulk density of 1,300 kg/m^3, the estimated environmental concentration (EEC) of butafenacil in soil would be 5.1 µg a.i./kg soil. As only one application per year is permitted and the aerobic soil metabolism DT50 is relatively fast (0.5-2.2 d), no accumulation is expected. The corresponding EEC for triasulfuron would be 13 µg a.i./kg soil.

TOUCHDOWN B-POWER HERBICIDE has the higher application rate of butafenacil at 40 g a.i./ha only once per year and not in conjunction with *LOGRAN B-POWER HERBICIDE*. Under the same scenario for *LOGRAN B-POWER HERBICIDE*, the concentration of butafenacil in soil would be 21 µg a.i./kg soil. As with *LOGRAN B-POWER HERBICIDE*, no accumulation in soil is expected. With a corresponding application rate of 1,800 g a.i./ha for glyphosate, the EEC would be 0.92 mg a.i./kg soil.

Concentration in water

In a worst-case scenario of a direct overspray of a 15 cm deep body of water with the maximum single application rate of 10 g a.i./ha for *LOGRAN B-POWER HERBICIDE*, the EEC would be 6.7 µg a.i./L. As only one application per year is permitted and the dissipation DT50 in natural water-sediment systems is relatively fast (3.7-6.1 d), no accumulation is expected. The corresponding EEC for triasulfuron is 17 µg a.i./L.

In a worst-case scenario of a direct overspray of a 15 cm deep body of water with the maximum single application rate of 40 g a.i./ha for *TOUCHDOWN B-POWER HERBICIDE*, the EEC would be 27 µg a.i./L. As with *LOGRAN B-POWER HERBICIDE*, no accumulation is expected. The corresponding EEC for glyphosate is 1.2 mg a.i./L.

Hazard to Terrestrial Organisms

There is no expected hazard to bobwhite quail or mallard ducks from the proposed use of butafenacil in *TOUCHDOWN B-POWER HERBICIDE* or *LOGRAN B-POWER HERBICIDE*.

Butafenacil is not expected to be an acute hazard to earthworms. Honey bees, carabid beetles, rove beetles, parasitic wasps and soil microoganism processes (respiration and nitrogen mineralisation) are not expected to be adversely affected by butafenacil at proposed rates as no effect was seen at 250 g a.i./ha. Although 100% mortality of predatory bugs and mites may be expected from the proposed rate, the use patterns of *TOUCHDOWN B-POWER HERBICIDE* and *LOGRAN B-POWER HERBICIDE*s early in the season may reduce the hazard. As butafenacil is a nonselective herbicide, nontarget terrestrial plants that are exposed to even small amounts are expected to be adversely affected.

No hazard to earthworms is expected from the metabolites CGA 293730 and CGA 380963.

Hazard to Aquatic Organisms
The direct overspray of a 15 cm deep body of water with the maximum proposed application rate of *TOUCHDOWN B-POWER HERBICIDE* would pose an unacceptable hazard to aquatic invertebrates, algae and macrophytes. For the metabolites CGA 293731 and CGA 293730, the hazard to algae may be mitigated. For *LOGRAN B-POWER HERBICIDE*, the hazard is unacceptable for algae and duckweed.

In the more likely exposure of water bodies by spray drift, a 10% drift would still result in unacceptable risk for algae and aquatic macrophytes (*TOUCHDOWN B-POWER HERBICIDE* only). A further refinement of drift from a low boom ground sprayer with a buffer zone of 10 m would give a drift of 0.36% necessary to reduce the risk to an acceptable level. However, the worst case EEC of triasulfuron from an application rate of 26 g a.i./ha in *LOGRAN B-POWER HERBICIDE* would produce an unacceptable hazard to duckweed. Only a buffer zone of at least 50 m would reduce the drift to 0.07% and the EEC to 0.012 µg a.i./L to give an acceptable hazard.

In a worst case run-off situation, the hazards from butafenacil and triasulfuron are unacceptable to algae and macrophytes, respectively. However, prohibiting application within 6 or 48 h of heavy rain being forecast, coupled with the proposed 20 m buffer for *TOUCHDOWN B-POWER HERBICIDE* and the recommended 50 m buffer zone for *LOGRAN B-POWER HERBICIDE* resepctively, should alleviate the potential hazard to algae/aquatic plants resulting from run-off.

The hazard from the metabolites CGA 293731 and CGA 293730 is acceptable if less than 10% of the originally applied parent compound were to be fully metabolised and run-off from treated areas.

Conclusions
Due to the low maximum application rate and the relatively low toxicity of butafenacil and its major metabolites to some organisms, the acute and chronic hazards to birds, earthworms, honeybees, carabid beetles, rove beetles, parasitic wasps and soil microoorganism respiration and nitrogen mineralisation processes are expected to be low.

The draft label for *TOUCHDOWN B-POWER HERBICIDE* prohibits application within 20 m of natural or impounded lakes or dams. This should be sufficiently protective to lead to an acceptable hazard from spraydrift from both butafenacil and glyphosate. However, to provide an adequate safety margin for algae and aquatic macrophytes from spray drift from triasulfuron in *LOGRAN B-POWER HERBICIDE*, the statement has been expanded to a buffer zone of 50 m and includes all other waterways. Calculations show the hazard from run-off will be mitigated by banning application if heavy rainfall is forecast within 6 or 48 h and observing buffer zones of 20 and 50 m for *TOUCHDOWN B-POWER HERBICIDE* and *LOGRAN B-POWER HERBICIDE* respectively. The company has agreed to amend the labels as outlined above.

The acute hazard to predatory bugs is unknown while that to terrestrial plants and predatory mites is unacceptable. Although the use pattern of the products should reduce the exposure to predatory bugs and mites, any impact on their populations should be compensated for by rapid recovery. The labels for both products prohibit application that may affect non-target plants.

EFFICACY AND SAFETY ASSESSMENT

(a) Justification for Use

LOGRAN B-POWER HERBICIDE will offer wheat growers a new option for rapid knockdown of a range of seedling weeds, including some difficult weeds such as mallows, prior to seeding as well as in crop residual control provided by the triasulfuron component. The product facilitates the move towards conservation and no-till and also assists in the management of and/or delays the development of a weed population resistant to Group B products.

The product's compatibility with traditional knockdown herbicides such as glyphosate and paraquat further indicates that this product will prove most useful in the grain belt of southern Australia. Plant back periods similar to straight triasulfuron are detailed on the label and will need to be complied with in the relevant soil type x rainfall conditions.

TOUCHDOWN B-POWER HERBICIDE, which is the combination of butafenacil with glyphosate, will prove useful for pre-plant control of weeds that are difficult to control with glyphosate alone. This product also facilitates the move towards conservation and no-till farming and also assists in the management and/or delay of weed populations resistant to Group B products.

(b) Adequacy of Efficacy Data

Trial designs are very good, with adequate controls, analyses of results and treatments selected. Treatments are consistent throughout the trials, which makes it easier to assess and compare results. This is both desirable and commendable on the part of the applicant. The stage of growth of weeds and crop are adequately described.

The experimental conditions were adequately recorded and all relevant details supplied. Trials were conducted in all major cereal growing areas.

Results were statistically analysed and data presented accordingly, with generally adequate interpretations being made.

All trials appear to have been carried out by qualified personnel and organisations and their reports presented in a suitable format.

The research and the additional yield data from plant-back trials, which was presented after the initial assessment, is appropriate for the registration requested. Trials were well documented and presented and relate well to the commercial use of the product.

(c) Claims

Adequate data are presented to support the claims for efficacy against the nominated weeds.

(d) Directions for Use

Directions for use are detailed and appropriate. The uses set out on the labels are compatible with current practices and warnings with respect to herbicide resistance management and plant back risks are adequate and clear. Scientific names have been included for target species.

(e) Safety to Target and Non Target Species, Adequacy of Precautionary Advice
There is a degree of phytotoxicity to some crops however field trial data demonstrate that there is no detrimental effect on yield and support the proposed label statements that sowing should not occur until 1 day after application.

(f) Conclusion
Sufficient data from suitably designed, scientifically conducted and statistically analysed trials has been presented to substantiate the claims for use as shown on the draft labels. As long as the products are used according to label instructions and Good Agricultural Practice they should be suitable for the proposed purposes.

LABELLING REQUIREMENTS

LABEL:

READ SAFETY DIRECTIONS BEFORE OPENING OR USING

LOGRAN®
B-POWER®

HERBICIDE

Active Constituents:
200 g/kg BUTAFENACIL
520 g/kg TRIASULFURON

Group	B	G	Herbicide

For the knockdown, pre-emergent and residual control of various weeds prior to planting wheat as per Directions for Use

IMPORTANT: READ THE ATTACHED LEAFLET BEFORE USE

1, 1.5, 2 kg NET

Syngenta Crop Protection Pty Limited
140-150 Bungaree Road, Pendle Hill NSW 2145
UN-Free
NRA Approval No:

In a transport emergency dial 000, Police or Fire Brigade
For specialist advise in an emergency only, call 1800 033 111 (24 hours)

STORAGE AND DISPOSAL

Store in the closed, original container in a cool, well ventilated area out of direct sunlight.
Rinse containers before disposal. Add rinsings to the spray tank. DO NOT dispose of undiluted chemicals on-site. Dispose of at a local authority landfill. If no landfill is available, bury the containers below 500 mm in a disposal pit specifically marked and set up for this purpose clear of waterways, desirable vegetation and tree roots. Empty containers and product should not be burnt.

SAFETY DIRECTIONS

Will irritate the eyes and skin. Avoid contact with eyes and skin. If product gets on skin, immediately wash area with soap and water. Wash hands after use. When opening container, preparing and using the prepared spray, wear:

- **cotton overalls buttoned to the neck and wrist (or equivalent clothing);**
- **a washable hat; and**
- **elbow length PVC gloves.**

After each day's use wash gloves and contaminated clothing.

FIRST AID

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

MATERIAL SAFETY DATA SHEET

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

MANUFACTURER'S WARRANTY AND EXCLUSION OF LIABILITY

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

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Batch No.	
Date of Manufacture	

Item Code
N1

LEAFLET:

READ SAFETY DIRECTIONS BEFORE OPENING OR USING

LOGRAN®
B-POWER®

HERBICIDE

Active Constituents:
200 g/kg BUTAFENACIL
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Group	B	G	Herbicide

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140-150 Bungaree Road, Pendle Hill NSW 2145

UN-Free
NRA Approval No:

In a transport emergency dial 000, Police or Fire Brigade
For specialist advise in an emergency only, call 1800 033 111 (24 hours)

DIRECTIONS FOR USE:

Pre-sowing application only.

Restraints:

DO NOT apply if wheat will be undersown with legumes.
DO NOT use if any other Group B (ALS Inhibitor) herbicide has been used during the current season.
Apply no more than two Group B herbicides in any four year period on the same paddock.
DO NOT tank mix with TOUCHDOWN B-POWER.
DO NOT use if TOUCHDOWN B-POWER has been used in the same season.
DO NOT apply by aircraft.
DO NOT apply if heavy rainfall that is likely to cause runoff is forecast within 48 hours of application.
DO NOT apply within 1 day of sowing.

Crop	Weeds Controlled	Rate / ha	Critical Comments
Wheat	**Annual Ryegrass (*Lolium rigidum*),** **Capeweed (*Arctotheca calendula*),** **Clover (*Trifolium spp.*),** **Doublegee or Three Cornered Jack or Spiny Emex (*Emex australis*),** **Medic (*Medicago spp.*),** **Sowthistle *(Sonchus oleraceus),*** **Volunteer Faba Beans (*Vicia faba*) and Field Peas (*Pisum sativum*)** **Wild Oats (*Avena fatua*),** **Wild Radish (*Raphanus raphanistrum*)** African Turnip Weed (*Sisymbrium thellungii*), Ball Mustard (*Neslia paniculata*), Black Bindweed or Climbing Buckwheat (*Polygonum convolvulus*), Burr Medic (*Medicago spp.*), Capeweed (*Arctotheca calendula*), Common Cotula (*Cotula australis*), Corn Gromwell or White Ironweed or Sheepweed (*Buglossoides arvensis*), Crassula (*Crassula sieberana*) Deadnettle (*Lamium amplexicaule*), Denseflower Fumitory (*Fumaria densiflora*), Hedge Mustard (*Sisymbrium officinale*), Indian Hedge Mustard (*Sisymbrium orientale*), Lesser Swinecress (*Coronopus didymus*), London Rocket (*Sisymbrium irio*), Matricaria (*Matricaria matricarioides*), Mexican Poppy (*Argemone mexicana*), New Zealand Spinach (*Tetragonia tetragonioides*), Paradoxa Grass (Annual Phalaris) (*Phalaris paradoxa*), Paterson's Curse (*Echium plantagineum*), Prickly Lettuce (*Lactuca serriola*), Rough Poppy (*Papaver hybridum*), Shepherd's Purse (*Capsella bursa-pastoris*), Skeleton Weed (*Chondrilla juncea*), Slender Celery (*Apium leptophyllum*), Smallflower Fumitory (*Fumaria parviflora*), Soursob (*Oxalis pes-caprae*), Stagger Weed (*Stachys arvensis*), Stemless Thistle (*Onopordum acaulon*), Turnip Weed (*Rapistrum rugosum*), Variegated Thistle (*Silybum marianum*), Vetch (*Vicia spp.*), Volunteer Chickpeas (*Cicer arietinum*), Faba Beans (*Vicia* faba) and Field Peas (*Pisum sativum*), Wards Weed (*Vella annua*), Wild Turnip (*Brassica tournefortii*), Wireweed (*Polygonum aviculare*), suppression of Wild Radish (*Raphanus raphanistrum*), Yellow Burrweed (Amsinckia) (*Amsinckia spp.*)	50 g Add a recomm-ended adjuvant at label rates.	If weeds are present prior to application, it is recommended to tank mix Logran B-POWER with a compatible knockdown herbicide (eg. Sprayseed or Touchdown) to ensure effective knockdown control. LOGRAN B-POWER provides knockdown control of some weeds (**listed in bold**) which have just emerged (up to 2 leaf stage). In conservation tillage situations, or where larger weeds (greater than 2 leaf stage) are present apply LOGRAN B-POWER as a tank mixture with the recommended rate of a knockdown herbicide. If the total green matter exceds 30% groundcover apply a separate application of a knockdown herbicide prior to application of Logran B-Power. Always add an adjuvant such as Hasten or a non ionic wetter at recommended rates. On large weeds and in less than ideal conditions the use of Hasten in preference to a non ionic wetter is recommended. For best results apply to moist soil prior to sowing and incorporate by the sowing operation. Application should not be made to ridged or excessively cloddy soil. For best results apply to moist soil when follow up rain is likely to occur within 7 to 10 days. LOGRAN B-POWER will provide good control of volunteer grain legumes, however a small proportion of plants may survive and require an overspray to eliminate the potential for grain contamination. For Skeleton Weed a significant degree of control will be achieved on soil types of a predominantly sandy clay loam mixture with a pH greater than 8. Best control is observed where Skeleton Weed germinates in the very early stages of the crop. Surviving plants will be stunted. For best results for Paradoxa Grass control apply to dry soil before the sowing rain.

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

WITHHOLDING PERIODS:
Grazing: DO NOT GRAZE OR CUT FOR STOCK FOOD FOR 7 WEEKS AFTER APPLICATION.
Harvest: NOT REQUIRED WHEN USED AS DIRECTED.

GENERAL INSTRUCTIONS

LOGRAN B-POWER is a water dispersible granular herbicide for the knockdown and pre-plant, incorporated by sowing, control of annual ryegrass, paradoxa grass and certain broadleaf weeds in wheat.

Crops other than wheat, barley, oats, triticale and cereal rye can be very sensitive to low soil concentrations of LOGRAN B-POWER, thus prior to using the product, careful consideration should be given to crop rotation plans.

Mixing

DO NOT mix, load or apply this product within 50 m of any well, sink hole, intermittent or perennial stream.

LOGRAN B-POWER is a water dispersible granular herbicide which mixes readily with water and is applied as a spray.

- Partly fill the spray tank with water.
- Start the agitation.
- Add the correct amount of product to the spray tank with the agitation system running.
- Continue agitation while topping up the tank with water and while spraying.
- Use the spray mix within 24 hours of preparation.

Mixing Order

Some products may react with other products if they are not mixed in the correct order. The general mixing order of products should be -

1. water conditioners or buffers
2. water dispersable granules (WG)
3. wettable powders (WP)
4. flowable or suspension concentrates (SC)
5. emulsifiable concentrates (EC)
6. water based or soluble concentrates
7. oils and wetters

It is important to ensure that each individual component of the tank mix is fully dissolved and in solution before the next product is added to the tank mix, otherwise mixing problems may occur.

Application

Spray equipment should be carefully calibrated before use. Complete coverage of weed seedling is required for maximum knockdown effect. A spray volume of 50 to 100 L/ha is recommended.

Cleaning Equipment After Application

Thoroughly clean the sprayer using the following procedure when you have finished spraying highly active materials such as sulfonylurea and butafenacil products.

1. Start with a thoroughly cleaned sprayer before beginning the next job.
   Mix only as much spray solution as needed. Immediately after spraying, clean equipment thoroughly using this procedure. Wear appropriate protective clothing.
   Flush tank, hoses, boom and nozzles with clean water.
2. Prepare a cleaning solution of 300 mL of household chlorine bleach (containing 4% chlorine) per 100 L of water. Ensure bleach used is fresh as it can degrade significantly over time resulting in a reduction in cleaning ability.
3. When available, use a pressure washer to clean the inside of the spray tank with this solution. Take care to wash all parts of the tank, including the inside top surface and lid.
4. Completely fill the sprayer with the cleaning solution to ensure contact of the cleaning solution with all internal surfaces of the tank and plumbing. Start agitation in the sprayer and thoroughly recirculate the cleaning solution for at least 15 minutes. All visible deposits must be removed from the spraying system and in cases where there is the possibility of heavy build up of residues the cleaning solution may need to be left in the tank overnight to ensure adequate decontamination of the tank.
5. Flush hoses, spray lines and nozzles for at least one minute with the cleaning solution.
6. Dispose of rinsate from steps 1 to 5 in an appropriate manner.
7. **Repeat steps 2 to 5.**
8. Remove nozzles, screens, and strainers and clean separately in the cleaning solution after completing the above procedures. Be careful with filters, as they can be a main source of contamination.
9. Rinse the complete spraying system with clean water.

The above method is only effective if the cleaning solution comes into contact with every surface or contact point that may contain even minute sulfonylurea or butafenacil herbicide residues. In some boom sprayers this may not be physically possible and hence it may be advisable to use a different boomsprayer, that has not been used to spray sulfonylurea or butafenacil herbicides, when spraying sensitive crops such as legumes and especially Canola.

Crop Rotation Guidelines

Unless otherwise specified (see table below), wheat, barley, oats, triticale and cereal rye can be planted the following season without restriction.

For other specified crops the LOGRAN B-POWER treated area may be replanted after the interval indicated in the table below. These recommendations are made on the assumption that LOGRAN B-POWER is applied to a wheat crop that reaches maturity in the season of application.

Soil pH (1:5 Soil:Water suspension method)	State	Replanting Interval	Minimum rainfall requirements between application and sowing the following crop	Crop
6.5 or less	WA, SA, NSW, Vic, Qld only	12 months	300 mm	Field peas, Linseed, Lucerne, Lupins, Medics**, Subterranean clover **, Faba beans, Chickpeas and Canola.
	NSW, Qld only	15 months	700 mm	Sorghum, Maize, Soybean, Cotton, Cowpea and Mung Bean.
		18 months	900 mm	Sunflowers.
6.6 to 7.5	NSW, Qld only	12 months	500 mm	Chickpeas and Canola.
		15 months	700 mm	Sorghum, Maize, Soybean, Cotton, Cowpea and Mung bean.
		18 months	900 mm	Sunflowers.

	WA, SA, Vic. only	22 months	500 mm	Field peas, Linseed, Lucerne, Lupins, Medics**, Subterranean clover **, Faba beans, Chickpeas, Canola, Sorghum, Maize, Soybean and Cotton.
7.6 to 8.5	Vic., SA only	12 months	250 mm	Barley, Oats, Cereal Rye for grain crops
			300 mm	Barley, Oats, Cereal Rye for hay crops
	NSW, Qld only	12 months	500 mm	Chickpeas and Canola.
		18 months	700 mm	Sorghum, Maize, Soybean, Cotton, Cowpea and Mung bean.
	WA, SA, Vic only	24 months	700 mm	Field peas, Linseed, Lucerne, Lupins, Medics**, Subterranean clover **, Faba beans, Chickpeas, Canola, Sorghum, Maize, Soybean and Cotton.
8.6 and above	Vic., SA only	12 months	250 mm	Barley, Oats, Cereal Rye for grain crops
			300 mm	Barley, oats, Cereal Rye for hay crops
	WA, SA, NSW, Vic, Qld only	24 months	700 mm	Field peas, Linseed, Lucerne, Lupins, Medics**, Subterranean clover **, Faba Beans, Chickpeas, Canola, Sorghum, Maize, Soybean and Cotton.

** Includes natural regeneration of Subterranean Clover and Medics. For all other crops seek advice from a Syngenta Crop Protection representative.

Compatibility

LOGRAN B-POWER is compatible with Spray-Seed*, Touchdown and glyphosate.
When using a tank mix of LOGRAN B-POWER and Spray-Seed*, add LOGRAN B-POWER, with constant agitation, to approximately half the total volume of water to be used.
Ensure that the LOGRAN B-POWER is fully dispersed.
Add the Spray-Seed*, fill the spray tank to full volume with water and mix thoroughly.
Apply tank mix immediately, under constant agitation.

Resistant Weeds Warning

LOGRAN B-POWER Herbicide is a member of the sulfonylurea and pyrimidindiones groups of herbicides. The product has the inhibitors of Acetolactase synthase (ALS) and protoporphyrinogen oxidase modes of action. For weed resistance management, the product is a Group B and G herbicide.

Some naturally-occurring weed biotypes resistant to the product and other inhibitors of ALS and protoporphyrinogen oxidase may exist through normal genetic variability in any weed population. The resistant individuals can eventually dominate the weed population if these herbicides are used repeatedly. These resistant weeds will not be controlled by this product or other inhibitors of ALS and protoporphyrinogen oxidase herbicides.

Since the occurrence of resistant weeds is difficult to detect prior to use, Syngenta Crop Protection Pty Limited accepts no liability for any losses that may result from the failure of this product to control resistant weeds.

Advice as to strategies and alternative treatments that can be used should be obtained from your local supplier, consultant, local Department of Agriculture, Primary Industries Department or a Syngenta Crop Protection representative.

PRECAUTION

Some crop yellowing or crop retardation may occur where stress factors such as water logging, drought, excessive soil acidity or alkalinity, nutrient or trace element deficiency, disease - Rhizoctonia, Take-All, cereal cyst nematodes or soil insects are present or occur following application.

Special care should be taken with regard to the application of LOGRAN B-POWER to durum wheat varieties as these may be more sensitive where the above stresses are present. In these situations crop recovery will be rapid provided the stress factors do not continue exerting a negative effect on the crop's growth.
Crop retardation may also occur in some instances where considerable late summer/early autumn weed growth occurs. Weeds such as goosefoot, *Chenopodium* spp. can release herbicidally active compounds into the soil.

PROTECTION OF CROPS, NATIVE AND OTHER NON-TARGET PLANTS

DO NOT apply on or near shrubs, trees, lawns or crops other than wheat.
DO NOT apply or drain or flush equipment on, or near trees or other plants, where their roots may extend or in situations where by movement of soil, or seepage, absorption of the herbicide may occur.
DO NOT apply under weather conditions or from spraying equipment that may cause spray to drift over nearby susceptible plants or crops, cropping lands or pastures.

DO NOT allow spray to drift onto adjacent crops and non-target plants.
DO NOT allow spray to drift onto adjacent fallow land.

PROTECTION OF WILDLIFE, FISH, CRUSTACEANS AND ENVIRONMENT
This product is very highly toxic to algae and aquatic plants. DO NOT apply this product within 50 m of natural or impounded lakes or dams.
DO NOT apply under meteorological conditions or from spraying equipment which could be expected to cause drift of this product or spray mix onto adjacent areas, particularly wetlands, waterbodies or watercourses.
DO NOT contaminate streams, rivers or waterways with the chemical or used containers.

STORAGE AND DISPOSAL
Store in the closed, original container in a cool, well ventilated area out of direct sunlight.
Rinse containers before disposal. Add rinsings to the spray tank. DO NOT dispose of undiluted chemicals on-site. Dispose of at a local authority landfill. If no landfill is available, bury the containers below 500 mm in a disposal pit specifically marked and set up for this purpose clear of waterways, desirable vegetation and tree roots. Empty containers and product should not be burnt.

SAFETY DIRECTIONS
Will irritate the eyes and skin. Avoid contact with eyes and skin. If product gets on skin, immediately wash area with soap and water. Wash hands after use. When opening container, preparing and using the prepared spray, wear:

- **cotton overalls buttoned to the neck and wrist (or equivalent clothing);**
- **a washable hat; and**
- **elbow length PVC gloves.**

After each day's use wash gloves and contaminated clothing.

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

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

MANUFACTURER'S WARRANTY AND EXCLUSION OF LIABILITY
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® Registered Trade Mark of a Syngenta Group Company

Batch No.	
Date of Manufacture	

Item Code
N1

LABEL :

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

*TOUCHDOWN*Ò
B-POWER Ô

HERBICIDE

Active Constituents:
5 g/L BUTAFENACIL
225 g/L GLYPHOSATE, present as the isopropylamine salt

Group	G	M	Herbicide

For the control of various weeds prior to planting cereal crops as per Directions for Use

IMPORTANT: READ THE ATTACHED LEAFLET BEFORE USE

20, 90, 100, 110 LITRES

Syngenta Crop Protection Pty Limited
140-150 Bungaree Road, Pendle Hill NSW 2145
UN-Free
NRA Approval No:
In a transport emergency dial 000, Police or Fire Brigade
For specialist advise in an emergency only, call 1800 033 111 (24 hours)
N1

STORAGE AND DISPOSAL

Store in the closed, original container in a cool, well-ventilated area out of direct sunlight.

20 L Drum

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

90L, 100 L or 110L Refillable Drum

Empty contents fully into application equipment. Close all valves and return to point of supply for refill or storage.

SAFETY DIRECTIONS

Will irritate eyes and skin. Avoid contact with eyes and skin. When preparing spray wear:

- **cotton overalls buttoned to the neck and wrist (or equivalent clothing) and**
- **elbow-length PVC gloves.**

After use and before eating, drinking or smoking, wash hands, arms and face thoroughly with soap and water. After each day's use wash gloves and contaminated clothing.

FIRST AID

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

MATERIAL SAFETY DATA SHEET

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For a copy phone 1800 067 108 or visit our website at www.syngenta.com.au

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Item Code

Batch No.	
Date of Manufacture	

Drum Muster Logo

LEAFLET:

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

*TOUCHDOWN*Ò
B-POWERÔ

HERBICIDE

Active Constituents:
5 g/L BUTAFENACIL
225 g/L GLYPHOSATE, present as the isopropylamine salt

Group	G	M	Herbicide

For the control of various weeds prior to planting cereal crops as per Directions for Use

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N1

DIRECTIONS FOR USE

Restraints:

DO NOT apply to annual weeds within 1 day or perennial weeds within 7 days of cultivating or sowing a cereal crop.
DO NOT make more than one application per season.
DO NOT tank mix with LOGRAN® B-POWER.
DO NOT use if LOGRAN B-POWER is to be used in the same season.
DO NOT apply by aircraft.
DO NOT apply if heavy rainfall that is likely to cause run-off is forecast within 48 hours of application.

Situation	Weeds Controlled	Rate/ha	Critical Comments
Prior to sowing a cereal crop with full soil disturbance by cultivation or sowing with a tyned implement	Canola (*Brassica napus*), Capeweed (*Arctotheca calendula*), Dock (seedling) (*Rumex crispus*), Doublegee/Three Cornered Jack /Spiny Emex (*Emex australis*), Goosefoot (*Chenopodium pumilio*), Lupins (*Lupinis spp.*), Marshmallow (*Malva parviflora*), Medic (*Medicago spp.*), Paterson's Curse (*Eschium plantagineum* , Sowthistle (*Sonchus oleraceus*), Sub Clover (*Trifolium spp.*), Wild Radish (*Raphanus raphanistrum*), Wild Turnip (*Brassica tournfortii*)	**up to 4 leaf stage** 0.8 to 1.6 L Add a recommended adjuvant at label rates. **greater than 4 leaf stage** 1.6 to 2.4 L Add a recommended adjuvant at label rates	Treat only actively growing weeds not under stress from low moisture, frost, cold, disease or waterlogging. If heavy grazing has occurred allow regrowth before spraying and use the higher rate. **Rate Selection**: Increase to higher rates late in the season or when treating under cold/overcast conditions. Full Disturbance with a cultivation or sowing with a tyned implement may start one day after treatment (7 days if large or perennial weeds are present) and should occur within 21 days after treatment. Where cultivation or sowing does not occur within 21 days, new weed growth may require further treatment with an alternative knockdown herbicide. **Crop Establishment**: Sowing should not proceed until conditions allow the formation of a satisfactory seedbed. See Crop Establishment for directions. **Adjuvants**: Always add an adjuvant such as Hasten, crop oil concentrate eg. DC Trate or non ionic wetter eg BS 1000 to the spray mix at recommended label rates.. On large weeds and in less than ideal conditions the use of Hasten in preference to a non ionic wetter is recommended.
	Deadnettle (*Lamium amplexicaule*), Sorrel (*Rumex acetosella*)	**Up to 4 leaf stage** 1.2 to 1.6 L Add a recommended adjuvant at label rates. **Greater than 4 leaf stage** 1.6 to 2.4 L Add a recommended adjuvant at label rates.	
	Turnip Weed (*Rapistrum rugosum*)	1.6 to 2.4 L Add a recommended adjuvant at label rates.	
	Barley Grass (*Hordium leporium*), Brome Grass, (*Bromus diandrus*), Volunteer Cereals, Wild Oats (*Avena fatua*)	**pre-tillering:** 0.8 to 1.6 L Add a recommended adjuvant at label rates. **post-tillering:** 1.6 to 2.0 L Add a recommended adjuvant at label rates	
	Annual Ryegrass (*Lolium rigidum*)	**pre-tillering:** 1.6 to 2.0 L Add a recommended adjuvant at label rates **post-tillering:** 2.0 to 2.4 L Add a recommended adjuvant at label rates	

DIRECTIONS FOR USE - CONTINUED

Situation	Weeds Controlled	Rate/ha	Critical Comments
Prior to establishing a cereal crop with an implement that gives minimal or no soil disturbance	Canola (*Brassica napus*), Capeweed (*Arctotheca calendula*), Deadnettle (*Lamium amplexicaule*), Dock (seedling) (*Rumex crispus*), Doublegee/Three Cornered Jack/Spiny Emex (*Emex australis*), Goosefoot (*Chenopodium pumilio*), Lupins (*Lupinis spp.*), Marshmallow (*Malva parviflora*), Medic (*Medicago spp.*), Paterson's Curse (*Eschium plantagineum*), Sorrel (*Rumex acetosella*), Sowthistle (*Sonchus oleraceus*), Sub Clover (*Trifolium spp*.), Turnip Weed (*Rapistrum rugosum*), Wild Radish (*Raphanus raphanistrum*), Wild Turnip (*Brassica tournfortii*)	2.0 to 3.2 L Add a recommended adjuvant at label rates	Treat only actively growing weeds not under stress from low moisture, frost, cold, disease or waterlogging. If heavy grazing of mature plants has occurred, allow regrowth before spraying and use the higher rate. **Rate Selection**: Use the lower rate on young weeds (Pre tillering or up to the 4 leaf stage); increase to higher rates where grasses reach tillering or where broadleaf weeds are greater than the 4 leaf stage. Increase to higher rates when treating under cold/overcast conditions. **Crop Establishment**: DO NOT sow into excessive trash. **Adjuvants**: Always add an adjuvant such as Hasten, crop oil concentrate eg. DC Trate or non ionic wetter eg BS 1000 to the spray mix at recommended label rates. On large weeds and in less than ideal conditions the use of Hasten in preference to a non ionic wetter is recommended.
	Barley Grass (*Hordium leporium*), Brome Grass (*Bromus diandrus*), Volunteer Cereals, Wild Oats (*Avena fatua*)	1.6 to 2.4L Add a recommended adjuvant at label rates	
	Annual Ryegrass (*Lolium rigidum*)	2.4 to 3.2 L Add a recommended adjuvant at label rates	
To commence a fallow	Annual Ryegrass (*Lolium rigidum*), Barley Grass (*Hordium leporium*), Brome Grass (*Bromus diandrus*), Canola (*Brassica napus*), Capeweed (*Arctotheca calendula*), Deadnettle (*Lamium amplexicaule*), Dock (seedling) (*Rumex crispus*), Doublegee/Spiny Emex (*Emex australis*), Goosefoot (*Chenopodium pumilio*), Lupins (*Lupinis spp.*), Marshmallow (*Malva parviflora*), Medic (*Medicago spp*.), Paterson's Curse (*Eschium plantagenium*), Sorrel (*Rumex acetosella*), Sowthistle (*Sonchus oleraceus*), Sub Clover (*Trifolium spp.*), Turnip Weed (*Rapistrum rugosum*), Wild Oats (*Avena fatua*), Volunteer Cereals, Wild Radish (*Raphanus raphanistrum*), Wild Turnip (*Brassica tournfortii*)	2.4 to 3.2 L Add a recommended adjuvant at label rates	Treat only actively growing weeds not under stress from low moisture, frost, cold, disease or waterlogging. If heavy grazing occurred allow regrowth before spraying. **Rate Selection:** Use the **lower rate** on young weeds (Pre tillering or up to the 4 leaf stage) or where cultivation is to follow within 21 days. Increase to **higher rates** where grasses reach tillering or where broadleaf weeds are greater than the 4 leaf stage. Increase to higher rates when treating under cold/overcast conditions. **Adjuvants:** Always add an adjuvant such as Hasten, crop oil concentrate eg. DC Trate or non ionic wetter eg BS 1000 to the spray mix at recommended label rates. Do not use a non ionic wetter in a fallow situation.

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

WITHHOLDING PERIODS:
Grazing: DO NOT GRAZE OR CUT FOR STOCK FOOD FOR 6 WEEKS AFTER APPLICATION.
Harvest: NOT REQUIRED WHEN USED AS DIRECTED.

GENERAL INSTRUCTIONS

Uses

TOUCHDOWN B-POWER is a non-volatile, water soluble liquid product with non-selective herbicidal activity. It is absorbed by plant foliage and green stems and moves through the plant from the point of contact to and into the root system. Effects may not be apparent for 3 days or longer under cool, cloudy conditions. TOUCHDOWN B-POWER will control emerged weeds only. Apply treatments to weeds which have at least one true leaf (broadleaf weeds) or two leaves (grasses) to provide an adequate surface area for herbicide uptake. TOUCHDOWN B-POWER may be used prior to sowing any cereal crop.

Weeds should be actively growing at time of treatment. DO NOT treat weeds under poor growing or dormant conditions (such as occur in drought, waterlogging, disease, insect damage or following frosts) as reduced weed control may result.

Reduced results may also occur when treating weeds heavily covered with dust or silt. Prior herbicide application may also induce stress in weeds.

Rainfall occurring up to 6 hours after application may reduce effectiveness. Heavy rainfall within 2 hours after application may wash the chemical off the foliage and a repeat treatment may be required. Delay treatment of plants wet with dew or rain, if water droplets run off when plants are disturbed. Avoid contact with foliage, green stems or fruit of crops, desirable plants and trees, since severe injury or destruction may result.

Crop Establishment

TOUCHDOWN B-POWER is recommended for control of emerged weeds prior to crop establishment. Suitable cultivation and/or sowing operations are required to provide seedbed conditions satisfactory for crop germination and development. Spraying early to control young weeds will favour preparation of suitable seedbeds. On friable soils and where there is only light cover of young weeds, sowing may proceed satisfactorily from one day after spraying. In situations of heavy weed growth sowing should be delayed until weed decay and soil conditions allow formation of a satisfactory seedbed. Incorporation of green or decaying vegetation and roots into the seedbed by cultivation or sowing may cause retarded crop emergence, particularly in cold and/or wet conditions.

Mixing

DO NOT mix, load or apply this product within 20 m of any well, sink hole, intermittent or perennial stream.
Fill the spray tank with one half the required amount of clean water and add the required amount of TOUCHDOWN B-POWER
Mix well before adding the remaining portion of water. Add the surfactant near the end of the filling process to minimize foaming. Placing the filling hose below the surface of the spray solution will prevent excessive foaming. Removing hose from tank immediately after filling will prevent back siphoning into water source.

Note: Reduced results may occur if water containing soil is used, eg water from ponds and unlined ditches, or if hard water containing calcium salts is used.
DO NOT mix, store or apply this product or spray solutions of this product in galvanised steel or unlined steel containers or spray tanks, since a highly flammable gas mixture may be formed.
Use stainless steel, aluminium, brass, copper, fibreglass, plastic or plastic-lined containers or spray tanks. Ensure the sprayer is free of any residue of previous spray materials.
Use spray solutions promptly.
Do not use mechanical agitators as these may cause excessive foaming. Spray tanks, pumps, lines and nozzles should be thoroughly rinsed with clean water following application to prevent corrosion.

Mixing Instructions for all Tank Mixtures

1. Fill the spray tank 1/3 to 1/2 full with clean water and start agitation.
2. Add recommended herbicide/insecticide/additive to the spray tank and mix thoroughly.
3. Add TOUCHDOWN B-POWER and the remaining water. Mix thoroughly.
4. Add surfactant, near the end of the filling process to minimize foaming.
5. Always maintain adequate agitation during application and use the tank mix promptly.

Mixing Order
Some products may react with other products if they are not mixed in the correct order. The general mixing order of products should be -

1. water conditioners or buffers
2. water dispersable granules (WG)
3. wettable powders (WP)
4. flowable or suspension concentrates (SC)
5. emulsifiable concentrates (EC)
6. water based or soluble concentrates
7. oils and wetters

It is important to ensure that each individual component of the tank mix is fully dissolved and in solution before the next product is added to the tank mix, otherwise mixing problems may occur.

Application
TOUCHDOWN B-POWER is a non-selective translocated herbicide. Direct spray contact, or even slight drift, may cause severe injury or destruction of any growing crop or other desirable plants including trees. Clean all equipment after use by thoroughly washing as outlined below.

Boom Equipment: Application of TOUCHDOWN B-POWER in spray volumes of 50 to 250 L/ha is recommended. Fan nozzle equipment is recommended, using pressures in the range 100 to 400 kPa. In drift sensitive situations use pressures towards the lower end of the range with appropriate drift reduction nozzles. Boom height must be set to ensure double overlap of nozzle patterns at the top of the weed canopy.

Cleaning Equipment After Application
Thoroughly clean the sprayer using the following procedure when you have finished spraying highly active materials such as butafenacil products.

1. Start with a thoroughly cleaned sprayer before beginning the next job.
2. Mix only as much spray solution as needed. Immediately after spraying, clean equipment thoroughly using this procedure. Wear appropriate protective clothing.
3. Flush tank, hoses, boom and nozzles with clean water.
4. Prepare a cleaning solution of 300 mL of household chlorine bleach (containing 4% chlorine) per 100 L of water. Ensure bleach used is fresh as it can degrade significantly over time resulting in a reduction in cleaning ability.
5. When available, use a pressure washer to clean the inside of the spray tank with this solution. Take care to wash all parts of the tank, including the inside top surface and lid.
6. Completely fill the sprayer with the cleaning solution to ensure contact of the cleaning solution with all internal surfaces of the tank and plumbing. Start agitation in the sprayer and thoroughly recirculate the cleaning solution for at least 15 minutes. All visible deposits must be removed from the spraying system and in cases where there is the possibility of heavy build up of residues the cleaning solution may need to be left in the tank for extended periods to ensure adequate decontamination of the tank.
7. Flush hoses, spray lines and nozzles for at least one minute with the cleaning solution.
8. Dispose of rinsate from steps 1 to 5 in an appropriate manner.
9. **Repeat steps 2 to 5.**
10. Remove nozzles, screens and strainers and clean separately in the cleaning solution after completing the above procedures. Be careful with filters, as they can be a main source of contamination.
11. Rinse the complete spraying system with clean water.

The above method is only effective if the cleaning solution comes into contact with every surface or contact point that may contain even minute butafenacil residues. In some boom sprayers this may not be physically possible and hence it may be advisable to use a different boomsprayer that has not been used to spray butafenacil, when spraying sensitive crops such as legumes and especially Canola.

Compatibility
TOUCHDOWN B-POWER is compatible with Logran®, Glean and Trifluralin.

Resistant Weeds Warning
TOUCHDOWN B-POWER Herbicide is a member of the pyrimidindiones and glycines groups of herbicides. The product has the inhibitors of protoporphyrinogen oxidase and inhibitors of EPSP synthase modes of action. For weed resistance management, the product is a Group G and M herbicide.
Some naturally-occurring weed biotypes resistant to the product and other inhibitors of protoporphyrinogen oxidase and inhibitors of EPSP synthase herbicides may exist through normal genetic variability in any weed population. The resistant individuals can eventually dominate the weed population if these herbicides are used repeatedly. These resistant weeds will not be controlled by this product or other inhibitors of protoporphyrinogen oxidase and inhibitors of EPSP synthase herbicides.
Since the occurrence of resistant weeds is difficult to detect prior to use, Syngenta Crop Protection Pty Limited accepts no liability for any losses that may result from the failure of this product to control resistant weeds.
Advice as to strategies and alternative treatments that can be used should be obtained from your local supplier, consultant, local Department of Agriculture, Primary Industries Department or a Syngenta Crop Protection representative.

PROTECTION OF CROPS, NATIVE AND OTHER NON-TARGET PLANTS
DO NOT apply under weather conditions, or from spraying equipment, that may cause spray to drift onto nearby susceptible plants/crops, cropping lands or pastures.
DO NOT apply or drain or flush equipment on or near 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
This product is very highly toxic to algae and aquatic plants. DO NOT apply this product within 20 m of natural or impounded lakes or dams.
DO NOT apply under meteorological conditions or from spraying equipment which could be expected to cause drift of this product or spray mix onto adjacent areas, particularly wetlands, waterbodies or watercourses.
DO NOT contaminate streams, rivers or waterways with the chemical or used containers.

STORAGE AND DISPOSAL
Store in the closed, original container in a cool, well-ventilated area out of direct sunlight.
20 L Drum
Triple or preferably pressure rinse containers before disposal. Add rinsings to spray tank. DO NOT dispose of undiluted chemicals on site. If recycling, replace cap and return clean containers to recycler or designated collection point. If not recycling, break, crush or puncture and bury empty containers in a local authority landfill. If no landfill is available, bury the containers below 500 mm in a disposal pit specifically marked and set up for this purpose clear of waterways, desirable vegetation and tree roots. Empty containers and product should not be burnt.
90L, 100 L or 110 L Refillable Drum
Empty contents fully into application equipment. Close all valves and return to point of supply for refill or storage.

SAFETY DIRECTIONS
Will irritate eyes and skin. Avoid contact with eyes and skin. When preparing spray wear:
- **cotton overalls buttoned to the neck and wrist (or equivalent clothing) and**
- **elbow-length PVC gloves.**

After use and before eating, drinking or smoking, wash hands, arms and face thoroughly with soap and water. After each day's use wash gloves and contaminated clothing.

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

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

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

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Item Code

Batch No.	
Date of Manufacture	

Drum Muster Logo

GLOSSARY

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

References

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

NRA PUBLICATIONS ORDER FORM

To receive a copy of the full technical report for the evaluation of butafenacil in the products Logran B-Power Herbicide and Touchdown B-Power herbicide, please fill in this form and send it, along with payment of $30 to:

David Hutchison
Agricultural Chemicals Evaluation Section
National Registration Authority for Agricultural and Veterinary Chemicals
PO Box E240
Kingston ACT 2604

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