Australian Government

Australian Pesticides and Veterinary Medicines Authority

DIURON

FINAL REVIEW REPORT

The reconsideration of the registrations of selected products containing diuron and their associated labels

NOVEMBER 2012

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CONTENTS

PREFACE V
EXECUTIVE SUMMARY VII
1 INTRODUCTION 1
2 REASONS FOR DIURON REVIEW 2
3 REGULATORY OPTIONS 4
4 HISTORY OF DIURON REVIEW 6
4.1 Proposed suspension (2005) 6
4.2 Preliminary Review Findings report (2005) 6
4.3 Toxicology and environmental assessment (2011) 8
4.4 Suspension of diuron (2011) 9
4.5 Regulatory decisions (March 2012) 10
4.6 Environmental Assessment (September 2012) 10
5 SUPPLEMENTARY CONSIDERATIONS 2012 16
6 REVIEW OUTCOMES (NOVEMBER 2012) 27
7 REGULATORY DECISIONS 33
REFERENCES 35
ABBREVIATIONS 36
APPENDIX A: PRODUCTS INCLUDED IN THE REVIEW AND REGULATORY OUTCOMES 39
APPENDIX B: DSEWPAC CONSIDERATION OF A NO-SPRAY WINDOW FOR SUGARCANE 44
APPENDIX C: DSEWPAC CONSIDERATION OF DUPONT KROVAR DF HERBICIDE (31253) 81

LIST OF TABLES

Table 1: Diuron uses 4
Table 2: September 2012 supported uses 12
Table 3: September 2012 uses not supported 13
Table 4: September 2012 label buffer zones 15
Table 5: 'No-spray' window sugarcane, region specific, Diuron-only products, pre-emergent application 1.8 kg ac/ha 17
Table 6: 'No-spray' window sugarcane, region specific, Diuron-only products, post-emergent 1.8 kg ac/ha application, 60% band spray 18
Table 7: 'No-spray' window sugarcane, region specific, Diuron/hexazinone products, pre-emergent 1.8 kg ac/ha application 18
Table 8: 'No-spray' window sugarcane, region specific, Diuron/hexazinone products, post-emergent 1.8 kg ac/ha application, 60% band spray 19
Table 9: 'No-spray' window pineapples, region specific, DuPont Krovar DF Herbicide, pre-emergent 4.5 kg product/ha application 23
Table 10: 'No-spray' window pineapples, region specific, DuPont Krovar DF Herbicide, post-emergent application 4.5 kg product/ha, 60% band spray 23

Table 11: 'No-spray' window pineapples, region specific, DuPont Krovar DF Herbicide, post-emergent application 2.2 kg product/ha, 60% band spray 24
Table 12: Supported uses and comments 27
Table 13: Unsupported uses and comments 28
Table 14: Downwind buffer zone 30

PREFACE

The Australian Pesticides and Veterinary Medicines Authority (APVMA) is an independent statutory authority with responsibility for the regulation of agricultural and veterinary chemicals in Australia. Its statutory powers are provided in the Agvet Codes scheduled to the *Agricultural and Veterinary Chemicals Code Act 1994*.

The APVMA can reconsider the approval of an active constituent, the registration of a chemical product or the approval of a label for a container for a chemical product at any time. This is outlined in Part 2, Division 4 of the Agvet Codes.

A reconsideration may be initiated when new research or evidence has raised concerns about the use or safety of a particular chemical, a product containing that chemical, or its label.

The reconsideration process includes a call for information from a variety of sources, a review of that information and, following public consultation, a decision about the future use of the chemical or product. The information and technical data required by the APVMA to review the safety of new and existing chemical products must be derived according to accepted scientific principles, as must the methods of assessment undertaken.

In undertaking reconsiderations (referred to as reviews hereafter), the APVMA works in close cooperation with advisory agencies including the Office of Chemical Safety (OCS) within the Department of Health and Ageing, along with the Department of Sustainability, Environment, Water, Heritage and the Arts (DSEWPaC) and state and territory departments of agriculture, as well as other expert advisers as appropriate.

The APVMA has a policy of encouraging openness and transparency in its activities and community involvement in decision-making. The publication of review reports is a part of this process. The APVMA also makes these reports available to the regulatory agencies of other countries as part of bilateral agreements. The APVMA recommends that countries receiving these reports will not utilise them for registration purposes unless they are also provided with the raw data from the relevant applicant.

The basis for the current reconsideration is whether the APVMA is satisfied that continued use of products containing diuron in accordance with the instructions for their use:

- would not be likely to have an effect that is harmful to human beings
- would not be likely to have an unintended effect that is harmful to animals, plants or things or to the environment.

The APVMA also considered whether product labels carry adequate instructions and warning statements.

The review of diuron active constituents, and the registration of products intended for use as cotton defoliants, anti-fouling paints, pond and aquarium products was completed in March 2012. At this time approvals of active constituents were affirmed, cotton defoliant labels were varied and registration was subsequently affirmed, and the registration and associated label approvals for anti-fouling paints, aquarium and pond products were affirmed. These conclusions were based on the published environmental and human health reports which identified no risk to the environment or human health from continued registration and approval in these situations. No further consideration was given in this assessment to these active constituents or products.

This report, *Diuron Final Review Report: The reconsideration of the registrations of selected products containing diuron and their associated labels,* relates to all other products containing diuron whose continued registrations are subject to the outcomes of the review. This report should be read with reference to the four diuron technical assessment reports prepared by DSEWPaC and published by the APVMA in September 2012.

The review's findings and regulatory decisions are based on information collected from a variety of sources. The information and technical data required by the APVMA to review the safety of new and existing chemical products must be derived according to accepted scientific principles, as must the methods of assessment undertaken.

This Final Review Report and associated technical assessment reports are available at the APVMA website: www.apvma.gov.au/products/review/index.php

EXECUTIVE SUMMARY

The Australian Pesticides and Veterinary Medicines Authority (APVMA) has completed its review of selected products containing diuron and their associated approved labels.

Diuron is a broad-spectrum residual herbicide that has been registered in Australia for over 20 years. Diuron is used in agriculture for pre and post-emergent control of broadleaf and grass weeds in sugarcane, cotton, broadacre cereals (oats, wheat, barley, triticale), apples and pears, lucerne, peas, vineyards and citrus and in tropical crops such as pineapples and bananas. It is used for weed control in irrigation channels and drainage ditches, around buildings, railway lines, sheds and driveways and other industrial applications.

In 2002, diuron active constituent approvals, product registrations and associated label approvals were placed under review as part of the APVMA's Review Program. Concerns included the impacts of diuron on marine environments, specifically the Great Barrier Reef and the effects of diuron on mangroves, coral and seagrass. There were also human health concerns associated with the toxicity of impurities in the active constituent.

In 2005, the APVMA released a Preliminary Review Findings (PRF) report which identified that current uses of diuron did not pose a risk to human health but could pose risks to the environment. Without significant changes to how these products were used (specifically a significant reduction in application rates) there was the potential for contamination of aquatic systems and adverse impacts on non-target aquatic and terrestrial organisms.

In 2011, the APVMA published toxicological and environmental assessment reports relevant to the review and at the same time proposed suspension of diuron products. These assessment reports considered information provided in response to the PRF report as well as the availability of new scientific information and international regulatory activity. The APVMA received over 100 submissions to the review at this time.

In November 2011, the APVMA suspended the registration of selected diuron products and issued new instructions for use during the period of suspension to reduce the risks in the short term. The suspension was put in place to mitigate risks while new information was considered.

In March 2012, the APVMA completed its review of diuron in respect of active constituent approvals and the registration of diuron products intended for use as cotton defoliants, anti-fouling paints and pond and aquarium products. These conclusions were based on findings from the 2011 toxicology and environmental assessments. At the same time, the suspension for the remaining diuron products was continued as the assessment had not yet concluded.

In September 2012, the APVMA published a Review Findings Report, together with four volumes of technical assessment prepared by The Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC). These reports were published ahead of the review's finalisation.

Final review outcomes 2012

On the basis of the findings contained in the 2012 DSEWPaC assessment and the subsequent consideration outlined in this report, the following regulatory decisions have been made in relation to diuron product registrations and associated label approvals listed in Appendix A:

a) Revoke the current suspension of products in order to implement the review findings.

b) Cancel product registrations—where no uses on the label can be supported on the basis of unintended effects to the environment (Table 1).

c) Vary label approvals— to remove those uses no longer supported on environmental grounds and to include additional information where necessary (restraints and environmental warning statements) (Table A-2).

d) Affirm product registrations (once variations have been made).

e) Cancel ‘old’ product label approvals— instructions on these labels are no longer considered adequate.

The APVMA review of diuron is now complete.

1 INTRODUCTION

The APVMA has reviewed the registration of selected products containing diuron and the associated label approvals and has made recommendations relating to the continued registration of these products in Australia.

This document must be read in conjunction with Volumes 1–4 of the Technical Reports prepared by the Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC) and published by the APVMA September 2012. These documents contain the detailed technical assessments that underpin the regulatory actions outlined in Section 7 of this document.

2 REASONS FOR DIURON REVIEW

In October 1994, the APVMA invited the public to nominate active constituents, chemical products or labels for consideration for review. Diuron was one of the 80 active constituents prioritised for review at this time. Community groups, individuals and government agencies nominated diuron for review on the basis of toxicological and environmental concerns.

The Great Barrier Reef was a key area of concern in relation to aquatic contamination due to the sensitive nature of this ecosystem. There were concerns about the impact diuron may have on aquatic areas that receive runoff from agricultural areas, the possible toxicity of some impurities in the active constituent, as well the relevance of findings of carcinogenicity in a rat study to humans.

In December 2002, the APVMA initiated the review of diuron.

2.1 Scope of the review

The scope of the review considered the reasons for the nomination of diuron, the information already available on this chemical and how it is approved for use in Australia. It was determined that registrations and approvals for diuron should be subject to reconsideration under Part 2, Division 4 of the Agvet Codes. The review scope was announced in the National Registration Authority (NRA) Gazette 12, 3 December 2002.

The APVMA reviewed the following aspects of active constituent approvals, product registrations and label approvals for diuron:

a) Toxicology, including:
   - toxicology of two impurities (3,3',4,4'-tetrachloroazobenzene and 3,3',4,4'-tetrachloroazoxybenzene) specified in the minimum compositional standard (MCS) for diuron active constituent
   - the potential for diuron to be a carcinogen.

b) Environment, including the:
   - impact of runoff water containing diuron on the Great Barrier Reef
   - impact of diuron found in sediment and water on various species of seagrass
   - potential role of diuron as a cause of dieback in mangroves
   - possible contribution of diuron in runoff water to reported incidents of off-target damage to farmlands.

The APVMA also considered whether product labels carry adequate instructions and warning statements. These instructions include:

- the circumstances in which the product should be used
- how the product should be used
- the times when the product should be used
- the frequency of the use of the product
- the withholding period after the use of the product
- the disposal of the product and its container
- the safe handling of the product.

The basis for a reconsideration of the registration and approvals for a chemical is whether the APVMA is satisfied the requirements prescribed by the Agvet Codes for continued registration and approval are being met. In the case of diuron, these requirements are that continued use of the product in accordance with the instructions for its use would not be likely to:

- have an effect that is harmful to human beings
- have an unintended effect that is harmful to animals, plants or things or to the environment.

3 REGULATORY OPTIONS

There can be three possible outcomes of reconsideration. Based on the information reviewed, the APVMA may be:

- **satisfied** the products and their labels continue to meet the prescribed requirements for registration and approval and therefore **affirms** the registrations and approvals
- **satisfied** the conditions to which the registration or approval is currently subject can be varied in such a way that the requirements for continued registration and approval will be complied with and therefore **varies** the conditions of registration or approval
- **not satisfied** the requirements for continued registration and approval continue to be met and **suspends** or **cancels** the registration and/or approval.

At November 2012, there were 62 products containing the active constituent diuron, whose registrations were previously suspended and have not had their registration cancelled or their labels changed and registration affirmed. These are listed in Appendix A.

Products containing diuron are used in a wide variety of crops (Table 1) for control of a diverse range of weeds (refer to product labels).

Table 1: Diuron uses

TREE AND VINE CROPS			
Apples and pears (established at least 1 year)	Citrus	Duboisia	Vineyards (vines must be older than 3 years)
BROADACRE CROPS			
Barley	Cereal rye	Cotton	Lucerne (established for 1 year or more)
Lupins	Oats	Peas	Perennial grass and seed crops, phalaris and cocksfoot
Phalaris cultivars sirolan and sirosa	Pulses – chickpea, faba beans, lentils, naibon beans, field peas, vetch	Summer fallows	Triticale
Wheat			
SUGARCANE, TROPICAL FRUIT, COFFEE AND TEA			
Bananas	Coffee	Pawpaws (not for use on trees under 9 months old)	Pineapple
Sugarcane	Tea		
MISCELLANEOUS			
Asparagus	Bore drains	Driveways, paths, lanes, drains, ditches, fence lines, car parks, factory sites, tennis courts	Irrigation channels, drainage ditches
Non-crop areas	Ornamentals – daffodils, gladioli and tulips, iris lilium	Right-of-way, commercial and industrial areas	

Diuron products are available in a range of formulation types (dry flowables, granules, soluble powders, suspension concentrates, wettable powders, water dispersible granules). Products within the review are formulated on their own or in combination with hexazinone or bromacil. Product labels contain directions for use of diuron in combination with other knockdown herbicides such as paraquat, MCPA, trifluralin, metalochlor or 2,4-D to achieve the most effective weed control.

Diuron products can be applied for either pre or post-emergent weed control. Maximum rates of diuron application vary significantly across the diuron product range—anything from 180 g ac/ha in cereals to 3.6 kg ac/ha in tropical and tree crops. In all situations, rates of applications are highest for pre-emergent weed control with post-emergent applications often only made to a proportion of the crop area such as under trees or between rows (band sprays) as opposed to the full crop area.

The highest rates of diuron application are for weed control in industrial or non-crop situations. These include bore drains, driveways, fence lines, car parks, factory sites, irrigation channels, drainage ditches, rights-of-way, commercial and industrial areas. When used in these situations, application rates can be as high as 90 kg ac/ha.

Diuron can be applied by ground or aerial application methods, high-volume spraying or with hand-held application for small areas of weed control (spot spraying).

Submissions to the APVMA diuron review provided valuable information on use practices occurring in various industries and the importance of diuron in these production systems. This information has been utilised in the assessment where appropriate. Many industries rely on diuron as a primary chemical for weed control while others, although they may have moved away from diuron, still rely on diuron for the control of certain weeds difficult to control with other chemicals.

4 HISTORY OF DIURON REVIEW

Since the APVMA commenced its diuron review in 2002, it has published reports on four separate occasions (Review Scope Document 2002, Preliminary Review Findings 2005, Environmental and Toxicology Assessments 2011, Review Findings Report and Environmental Assessment 2012), proposed suspension action twice (2005 and mid 2011) and taken suspension action (end 2011). Further information relating to these activities is provided below.

4.1 Proposed suspension (2005)

In 2005, the APVMA received the draft environmental assessment report from DSEWPaC that identified that runoff containing diuron was having unacceptable effects on the environment, specifically mangroves, seagrasses and the Great Barrier Reef.

To reduce this risk, the APVMA proposed to limit the use of diuron to a maximum rate of application in sugarcane of 0.9 kg ac/ha (i.e. a 75% reduction, equal to broadacre rates). This would theoretically reduce peak levels to close to the lowest observable effect concentration (LOEC) for mangroves, seagrasses, coastal coralline algae and corals. This was to be achieved by suspending diuron's registration and issuing new instructions for use.

Registrants were advised of the proposed suspension in March 2005. The main points of contention with this proposal as raised by registrants and user groups at this time were:

- The haste of the proposed suspension was considered excessive and in conjunction with the lack of consultation with industry, resulted in insufficient time to enable investigation of further alternatives.
- The proposal presented only a limited number of options— rate reduction or cancellation of the use.
- There appeared to be very little justification for the significant reduction in application rates for sugarcane. There was concern the proposed suspension decision and associated rate reduction was based on a single incident of mangrove dieback in the Pioneer River (Mackay region, Queensland) where limited science pointed to diuron as the cause. No other incidents near diuron areas of use had been reported.
- Continued use of diuron at reduced rates should only be undertaken in conjunction with a scientifically-valid assessment. This should include the role of management practices as well as investigations into the potential impact of reduced rates on weed control efficiency, diuron's place in minimum till agriculture and the introduction of replacement herbicides. This was not done.
- Registrants advised they had no efficacy information available to support a rate reduction (to 0.9 kg ac/ha).
- While some areas of horticulture indicated the lower rates could be accommodated (apples and pears, bananas and pawpaw) others considered the measures unnecessary, and, if implemented, would significantly impact production.

On the basis of these comments, the APVMA chose not to proceed with suspension action but to proceed to publish the Preliminary Review Findings (PRF) report.

4.2 Preliminary Review Findings report (2005)

In 2005, the APVMA published its Preliminary Review Findings (PRF) report. This report addressed the toxicological as well as the environmental aspects of the registration of diuron products in Australia.

The PRF report identified that significant restrictions on diuron use would be required to ensure continued protection of the environment. Recommendations made in this report were that:

- Active constituent approvals could be affirmed, on the basis of limited human health concerns.
- Environmental exposure from uses of diuron at current label rates in irrigation channels and drainage ditches was likely to have an unacceptable environmental impact and use was recommended for cancellation.
- Environmental exposure from uses of diuron at current label rates on sugarcane, cotton, citrus, horticultural crops (apples, pears, bananas, pawpaw, coffee, grapes and pineapples) and general purpose non-crop uses would likely have an unacceptable environmental impact with risk mitigation strategies required to substantially reduce the environmental load, including a reduction in application rates.
- An unacceptable environmental risk posed from spray drift (from fine sprays and current high label rates) from diuron use when applied by air and ground spray to winter cereals and cotton, which could be managed with the introduction of appropriate buffer zones.
- The use of diuron for algal control in aquariums and ornamental ponds, in anti-fouling paints, broadacre crops (wheat, barley, triticale, oats, lucerne, lupins and grass seed crops) asparagus, summer fallow, peas, vineyards, duboisia and ornamentals (daffodils, gladioli and tulips) could be retained.

The report was made available for a 2–month public consultation after which the APVMA intended to proceed to finalise the review.

Consideration of comments on PRF report

The publication of the PRF report in 2005 resulted in 23 submissions to the review. These submissions identified concerns with technical aspects of the review, together with comments on the proposed findings and the implications of these for continued use of diuron.

Submissions were received from state and territory governments with an interest in agriculture and water quality as well as from universities and other research organisations, user groups, chemical manufacturers, the general public and environmental groups. The information provided included scientific data, results of water monitoring programs and comprehensive information on the role of diuron in various agricultural production systems.

Some common themes raised in submissions to the PRF (2005) were:

- the validity of assumptions used in risk assessment
- diuron use in irrigation channels and non-agricultural areas
- the importance of diuron
- the availability and effectiveness of alternatives
- sediment loss
- continued support for diuron anti-fouling paints
- damage to mangroves
- buffers.

Provision of additional data (post PRF)

As outlined in the PRF report, the data package to support continuation of many diuron uses from an environmental perspective was insufficient. In response, additional data was made available for assessment.

Water monitoring results from a number of areas (agricultural and marine) were provided for consideration. This covered the Barwon and Mackay/Whitsunday regions, Great Barrier Reef, field sampling data from New South Wales, data from the Namoi, Gwydir and Border river valleys, monitoring data and work in drainage canals in rice-growing areas between Leeton and Griffith (NSW) modelling information from the Pioneer River (Qld) and from the Sunraysia water monitoring project (Vic). Results from the Mackay Mangrove Nursery project addressing the germination potential of mangrove propagules taken from dieback areas and then replanted into dieback areas were also provided. Additional spray drift modelling data was generated from AgDrift.

As a registrant involved in the review, DuPont, undertook additional work to investigate ways the environmental load of diuron could be reduced in the sugar industry. High-level modelling data indicated significant reductions in water contamination resulting from runoff could be achieved by altering management practices. These practices included decreasing the amount of diuron applied to 0.9 kg ac/ha through band spraying, limiting application to specific times of the year to avoid the wet season, improved cultivation using reduced tillage, adding vegetative buffer strips and sugarcane trash layers, not planting sugarcane on slopes >5% and the actual proximity of the treated area to waterways.

DSEWPaC also provided comment on the comprehensive guidelines prepared under the Queensland Government's reef protection legislation for use of diuron in sugarcane. These regulations were designed to minimise the drift and runoff of diuron-based products from sugarcane properties into the Great Barrier Reef lagoon.

4.3 Toxicology and environmental assessment (2011)

In July 2011, the APVMA published revised toxicology and environmental assessment reports for the review of diuron. These reports considered the information provided in response to the 2005 PRF.

Toxicology assessment

The 2011 toxicology report consolidated data on metabolism, subchronic and chronic toxicity, reproductive and developmental toxicity and genotoxicity. The full technical assessment report is available on the APVMA website.

On the basis of this assessment, in March 2012 the APVMA affirmed the approvals of diuron active constituents.

Environmental assessment

The 2011 environmental assessment report found that current rates of application of diuron present a risk to aquatic systems in most situations. Very low use rates (up to 200 times lower) may be acceptable in some situations from an environmental perspective but it is not known if the products are effective at very low rates.

On the basis of the findings of this assessment, DSEWPaC recommended to the APVMA that it was not satisfied the continued use of diuron would not be likely have any unintended effects harmful to animals, plants or things or to the environment.

The APVMA published a revised environmental assessment report in July 2011, with a 2-month period of public comment.

At the same time, on the basis of the findings of the 2011 environmental assessment report, the APVMA proposed to suspend the registration of diuron products and restrict use of diuron in certain situations while it allowed stakeholders to review the report and provide any information relevant to the APVMA's proposed decision to restrict or cancel most registrations.

Public comment on the 2011 report

The release of the revised environmental assessment in 2011 and the proposed suspension of diuron generated significant comment and provision of new information. The APVMA received over 100 submissions to the review at that time.

The main theme of submissions related to the relevance and applicability of the Murrumbidgee Irrigation Area (MIA) monitoring data to predict diuron concentrations in runoff water for all uses of diuron. This was especially the case for broadacre, dryland farming where arguments consistently related to the limited rainfall in the farming regions and lack of surface waters over much of the year, minimising the potential for contamination of aquatic areas.

Other issues raised by submissions included:

- selection of end points in the assessment
- inability to comply with suspension instructions including no-spray window and buffers
- availability of new information not previously provided, including the new reef requirements for diuron use in Queensland
- the variation in climatic conditions and potential for runoff in Western Australia
- situations of low application rates and therefore limited potential for runoff
- the importance of diuron in various industries
- management practices used to reduce potential for runoff
- lack of alternatives
- relevance of current label statements mostly in respect of application rates
- risk to birds in various cropping situations.

Where possible the comments were considered in the assessment of 2012 and are addressed further in Technical Report Volume 4: *Responses to submissions.*

4.4 Suspension of diuron (2011)

Following initial consideration of the submissions to the review in 2011, the APVMA determined that additional time was needed to adequately assess all submissions. At the same time however, the concerns first identified with diuron in the 2005 PRF had not significantly changed. As a result, while the information was being assessed the APVMA determined it appropriate to take action to reduce the risks in the short term. This was achieved by suspending registration and label approvals and issuing new instructions for the use of suspended diuron products. The suspension was in force from 28 November 2011 to 31 March 2012.

The suspension enabled the APVMA to reduce a major concern with continued high use rates of diuron, which was the risk of diuron runoff into waterways.

The suspension prohibited use around agricultural buildings, in right-of-way areas, on driveways, paths, lanes, drains, ditches, fence lines, car parks, tennis courts and in non-crop areas. Use of diuron was not permitted on bananas, coffee, pawpaws, pineapples, sugarcane or tea from 5 December 2011 to 31 March 2012. Use in factory sites, commercial and industrial areas was only permitted if the area was adequately bunded to retain any runoff, the use in irrigation channels or drainage ditches only permitted if all irrigation tailwater and rainfall could be captured and held on farm and application to tree crops was only permitted as a directed band spray over a maximum of 50% of the area.

Additional restraints designed to reduce the potential for runoff were also introduced. These included a maximum rate of application of 1.8 kg ac/ha, restrictions on application methods (no aerial application, coarse spray only) together with the requirement for addition environmental restraint statements.

4.5 Regulatory decisions (March 2012)

On the basis of the toxicology and environmental assessment reports published in July 2011, the APVMA finalised the review for active constituents and selected products (anti-fouling paints, aquarium and pond products, cotton defoliants) in March 2012.

At the same time the APVMA extended the suspension for the remaining diuron products until 30 November 2012 to allow for the assessment of the new information and reissued new instructions for use of suspended products.

Although the suspension instructions issued in 2012 did not change from those issued in 2011, their effect was that use in tropical situations was now permitted. This was on the premise that the risk of rainfall and subsequent runoff was expected to be less from April to November each year than during the wetter months (December–March). Rates of application in these circumstances were restricted to a maximum of 1.8 kg ac/ha.

4.6 Environmental Assessment (September 2012)

The APVMA and DSEWPaC considered all of the environmental data and information submitted for the review together with new information available in the public domain since the commencement of the review. The September 2012 assessment addressed the issues raised in submissions in response to the diuron environmental risk assessment report published by the APVMA in 2011 and focused largely on the risk to aquatic organisms from runoff. The environmental technical report contained four volumes that are available on the APVMA website.

Runoff risk assessment

A comprehensive assessment of risks to algae and aquatic plants was undertaken based on:

- information and argument provided in submissions
- the refinement of modelling
- intensive use of Australian-specific climatic data to assess different cropping situations and regions.

The methodology used in the 2012 report substantially built on the modelling capacity from the 2011 report and, in developing the new framework allowed a consistent approach across the large range of use patterns and growing conditions for diuron. Validation of the model was undertaken wherever possible using the most recent monitoring data.

This approach provided a separate runoff risk assessment for broadacre cropping situations, such as cereals which are grown under conditions of lower rainfall and limited surface water flow compared with the tropical and sub-tropical areas where rainfall is much greater. By being able to factor the specific conditions under which diuron is likely to be applied (including the type of soil, its moisture levels and amount of cover, the probability of rain falling during this time as well as possible stream flow conditions during this period) the revised assessment allowed crop-specific recommendations and expanded the ranges of uses for which runoff risk was acceptable compared with the 2011 report.

Additional data (environmental fate and toxicity)

Additional new data addressed the impact of diuron on sediment microbial communities. These findings help alleviate previous concerns regarding long-term exposure of aquatic flora when exposed through sediment pore water as the results from this study demonstrated that diuron contamination via runoff and erosion may stimulate the diuron mineralisation capacities of the sediments.

Many papers published since the APVMA's 2011 assessment reports addressed the issue of diuron mobility, mainly in relation to increased sorption of diuron with increasing time after application. Several literature papers describing higher tier aquatic toxicity testing were provided to address the issues surrounding recovery and pulse exposure effects on aquatic plants and communities.

In relation to the diuron environmental fate assessment, the distribution constant Kd (soil/water partition coefficient) was revisited and data obtained from field studies and environmental monitoring conducted under the Queensland Reef Rescue program examined. The outcomes of these studies and monitoring were critical in the revised runoff risk assessment, including the validation of results from the refined runoff model.

The outcomes of the additional ecotoxicity data assessment confirmed the aquatic end point employed in the 2011 environmental assessment report as well as allowing revisions to the assessment of risk to sediment flora.

September 2012 recommendations

DSEWPaC recommended the APVMA should no longer be satisfied that the use of diuron in accordance with label instructions for many situations would not be likely to have an unintended effect that is harmful to animals, plants or things or to the environment.

On the basis of this advice, the APVMA made the following recommendations in relation to the continued use of diuron products in Australia.

Table 2: September 2012 supported uses

SITUATION	COMMENTS
Asparagus	Use on labels is currently All States. The assessment has only considered information in relation to the major production in Victoria. Use will be restricted to Victoria only via label instructions.
Bananas	Only the use on the label in combination with paraquat (lower rate 250 g ac/ha to 450 g ac/ha) is supported.
Bore drains	Continued use supported based on unique characteristics of the areas in which this use occurs.
Cotton	**Irrigated cotton only** – Maximum rates of application (up to 1.8 kg ac/ha) are supported only when irrigation tailwater and up to 25 mm rainfall can be captured.
Factory sites, commercial and industrial areas	Only where sites are adequately bunded to retain all runoff.
Irrigation channels, drainage ditches	Only where all water can be contained on farm.
Lupins	Continued use supported at rates of 900 g ac/ha.
Pulses (including chickpea, faba beans, lentils, naibon beans, field peas, vetch)	Only supported where no-till farming practices are utilised (label statement required).
Sugarcane	**Diuron only products** – When used in combination with paraquat rates 250 g ac/ha up to 450 g ac/ha. **Diuron/hexazinone products** – only low rate of 250 g ac/ha supported and spot spraying.
Summer fallows	Only very low rate of application (0.25 kg ac/ha), continued use supported.
Wheat, barley, oats, triticale, cereal rye	All rates of application can continue.

Table 3: September 2012 uses not supported

SITUATION	COMMENTS
Apples and pears (established at least 1 year)	Use only supported in Goulburn Valley (label restraint). Risk in other areas, even at lower rates of application not supported mostly based on larger slopes therefore increased runoff. A number of areas fail on tier 1 assessment and have insufficient information to progress to tier 2. Control of use issues mean that such a restriction could not be enforced.
Bananas	High rates of application cannot continue.
Citrus	High rates of use (up to 3.6 kg ac/ha). Tier 1 assessment, based on apple and pear assessment, indicates unacceptable risk from continued use even taking into consideration that only 50% of the area is treated. DSEWPaC addressed issues raised in citrus submission.
Coffee	Rates of application too high resulting in unacceptable risk from tier 1 assessment. Assessment based on sugarcane areas of use as limited information on coffee growing regions.
Cotton	Dryland cotton with no ability to capture rainfall cannot be supported.
Driveways, paths, lanes, drains, ditches, fence lines, car parks, tennis courts	Use in these situations is at high application rates with limited or no potential to control runoff.
Duboisia	No information provided in submissions for this use. Labels indicate use in NSW and Qld so can assume similar areas of use to sugarcane. Rates of application are a single rate of 1.8 kg ac/ha. Even if band spraying under trees, use would be unacceptable.
Lucerne (established for 1 year or more)	Rates of application at 750 g ac/ha can be supported on environmental grounds however this rate is outside the range on current labels. To continue the use, the issue of the efficacy of these lower rates would need to be addressed. This would be done through the registration process and is not the role of the Chemical Review process.
Non crop Areas	Rates of application high and risk unacceptable. Only for control of giant sensitive plants in WA.
Ornamentals (daffodils, gladioli and tulips)	Rate of application are high (1.35–1.8 kg/ac). Tier 1 assessment shows unacceptable risk. No further information available to progress to tier 2 assessment.
Pawpaws (not for use on trees under 9 months old)	High rate of application resulting in unacceptable risk.
Peas	Continued use not acceptable as rates of application result in unacceptable risk.
Perennial grass and seed crops, phalaris and cocksfoot	Continued use not acceptable based on tier 1 level assessment. Insufficient information on area of use to allow a more detailed analysis, although using similar areas of use to wheat etc., results in unacceptable risk.
Phalaris cultivars sirolan and sirosa	Continued use not acceptable based on tier 1 level assessment. Insufficient information on area of use to allow a more detailed analysis, although using similar areas of use to wheat etc., results in unacceptable risk.
Pineapple	Rates of application high in areas of high rainfall and large slopes resulting in unacceptable runoff.
Rights-of-way	Use in these situations is at high application rates with limited or no potential to control runoff. Continued use cannot be supported.
Sugarcane	Not supported use in sugarcane for pre-emergent use and post-emergent use at rates of 1.8 kg ac/ha or band sprayed at lower rates.

SITUATION	COMMENTS
Tea	Continued use is not supported based on tier 3 in-stream analysis as well as consideration of mitigation options.
Vineyards (vines must be older than 3 years)	Information from tier 1 assessment indicates unacceptable risk based on regions from apple assessment. Rates of application are high and compliance with 3% slope unlikely.

September 2012 Label restraints

All products

DO NOT apply by air

DO NOT use in water-logged areas

DO NOT apply if greater than 50 mm rain fall is expected within 3 days of application

DO NOT irrigate within 3 days of application

DO NOT apply to fields where the slope exceeds 3%

Apply as a **COARSE** spray only

DO NOT spot spray greater than 5% of total farm area

Use-specific

Cotton (irrigated only)

DO NOT USE in **cotton UNLESS ALL** irrigation tailwater and up to 25 mm rainfall can be captured and held on farm

Pulse crops

DO NOT USE in pulse crops **UNLESS** application can be made using no-till farming practices

Irrigation channels/drains

DO NOT USE in **irrigation channels or drains UNLESS ALL** irrigation tailwater and rainfall can be captured and held on farm

Commercial products

DO NOT USE in factory sites, commercial and industrial areas **UNLESS** the area is adequately bunded to retain any runoff

Desert channels (bore drains)

DO NOT apply from 1 December to 30 March each year

DO NOT apply more than once per calendar year

DO NOT open drains for as long as possible following treatment

Label buffer zones

DO NOT apply when there is non-target terrestrial vegetation within **(see Table 4) m** downwind from the application area

DO NOT apply when there are aquatic areas within **(see Table 4) m** downwind from the application area.

Table 4: September 2012 label buffer zones

SITUATION	RATE (G AC/HA)	DOWNWIND BUFFER ZONE (M)	
		AQUATIC	TERRESTRIAL
BROADACRE CROPS / SITUATIONS			
Winter cereals			
Wheat, barley, triticale, cereal rye and oats, WA only	250–500	30	60
Wheat, barley, triticale and oats, WA only	180–250	15	30
Wheat, barley and oats, NSW, Vic, ACT and SA only	450	25	50
Wheat and barley, SA only	640–880	50	100
Wheat and barley, NSW, Vic, ACT and SA only	250	15	30
Summer fallow, SA only	250	15	30
Cotton Irrigated cotton, capacity to retain runoff	900–1,800	100	200
Lupins, WA only	990	30	80
Pulses Incorporated by wowing	750–990	30	80
Post sowing pre-emergent	495–750	50	100
Tropical / Sub-tropical crops – sugarcane, bananas	250–450	25	50
Miscellaneous – asparagus	1,800	100	200
Bore drains (Qld only)	32,000	N/R	N/R

5 SUPPLEMENTARY CONSIDERATIONS 2012

In September 2012, as well as publishing the Review Findings Report and associated environmental technical assessment prepared by DSEWPaC, the APVMA requested diuron product registrants to 'show cause' why the APVMA should not finalise the review on the basis of the findings contained within the 2012 report.

At the same time, the APVMA held a seminar for registrants and subsequently met with Queensland Government authorities involved in chemical regulation as well as pineapple growers, Canegrowers and representatives from the World Wildlife Fund to discuss the findings of the 2012 assessment.

In response to these actions, the APVMA received information from diuron product registrants, Queensland regulatory authorities and Canegrowers, relating to specific issues including:

- the impact of a 'no-spray' window in sugarcane
- consideration of the risks arising from the use of *DuPont Krovar DF Herbicide (31253)* (not covered by the 2012 assessment, only containing 400 g diuron active constituent in combination with bromacil)
- recommendations for use in lucerne
- recommendations for use cotton (irrigated and dryland).

DSEWPaC considered these submissions when preparing two supplementary assessment reports: the first considered the impact of a no-spray window in sugarcane, and the second addressed the risks arising from use of the product *DuPont Krovar DF Herbicide (31253).* The findings from the assessment are discussed briefly below, with the full assessments contained in Appendix B and Appendix C of this report.

5.1 No-spray window for sugarcane

At the time of suspension of selected diuron products in November 2011, the APVMA imposed a 'no-spray' window for diuron use in tropical crops including sugarcane, tea, coffee, pawpaw, pineapple and bananas. This had the effect of prohibiting use of diuron in these situations from 5 December to 31 March. The intention of the 'no-spray' window is to discontinue the use of diuron during periods where the risk of runoff is greatest whilst allowing use at other times. Preliminary consideration of this risk mitigation measure in the 2011 assessment report (section 1.5.15) had shown this can significantly reduce the risks in some areas.

However a full assessment of the impact of this window was not undertaken for the September 2012 report as advice from Canegrowers indicated that such a mitigation measure would not be preferred by their industry.

Subsequent requests from diuron product registrants and a revised position from Canegrowers in relation to the adoption of 'no-spray' window restrictions within sugarcane has led the APVMA to undertake a further assessment of the impacts of this risk mitigation measure.

The no-spray window proposed by registrants was from 1 November to 30 April each year. The window proposed by Canegrowers was from 1 January to 30 March each year. Each proposal has been considered separately, with the detailed assessment provided in Appendix B.

The assessment of the registrants' proposal is based on spray periods of 3 months. The approach used in the assessment of the Canegrowers' proposal was to assume no use in January, February and March and then consider the likely risk in individual months either side of this window to determine the risk.

In both cases the assessment considered three different use scenarios:

- Pre-emergent application (max 1.8 kg ac/ha, blanket spray 100% coverage).
- Post-emergent application (max 1.8 kg ac/ha 85% coverage).
- Post-emergent application (max 1.8 kg ac/ha 60% coverage).

These three approaches have resulted in slightly different outcomes as can be seen by the results in Appendix B.

A similar assessment has been conducted for diuron/hexazinone combination products but only on the basis of the 3-month approach. The results from this assessment are found in Table 7 and Table 8. It should be noted that for diuron/hexazinone products, the September 2012 assessment supported use at rates up to 450 g ac/ha without the need for a 'no-spray' window.

Table 5: 'No-spray' window sugarcane, region specific, Diuron-only products, pre-emergent application 1.8 kg ac/ha

	WET TROPICS	BURDEKIN/DRY	MARY/BURNETT	MACKAY/WHITSUNDAY	NSW
November	**No-spray**	**Spray**	**No-spray**	**No-spray**	**No-spray**
December	**No-spray**	**No-spray**	**No-spray**	**No-spray**	**No-spray**
January	**No-spray**	**No-spray**	**No-spray**	**No-spray**	**No-spray**
February	**No-spray**	**No-spray**	**No-spray**	**No-spray**	**No-spray**
March	**No-spray**	**Spray**	**No-spray**	**No-spray**	**No-spray**
April	**No-spray**	**Spray**	**No-spray**	**No-spray**	**No-spray**
May	**No-spray**	**Spray**	**No-spray**	**No-spray**	**Spray**
June	**No-spray**	**Spray**	**Spray**	**Spray**	**Spray**
July	**No-spray**	**Spray**	**Spray**	**Spray**	**Spray**
August	**No-spray**	**Spray**	**Spray**	**Spray**	**Spray**
September	**No-spray**	**Spray**	**Spray**	**Spray**	**Spray**
October	**No-spray**	**Spray**	**Spray**	**Spray**	**Spray**

Table 6: 'No-spray' window sugarcane, region specific, Diuron-only products, post-emergent 1.8 kg ac/ha application, 60% band spray

	WET TROPICS	BURDEKIN/DRY	MARY/BURNETT	MACKAY/WHITSUNDAY	NSW
November	No-spray	Spray	No-spray	Spray	No-spray
December	No-spray	Spray	No-spray	No-spray	No-spray
January	No-spray	No-spray	No-spray	No-spray	No-spray
February	No-spray	No-spray	No-spray	No-spray	No-spray
March	No-spray	Spray	Spray	No-spray	No-spray
April	No-spray	Spray	Spray	No-spray	Spray
May	No-spray	Spray	Spray	Spray	Spray
June	No-spray	Spray	Spray	Spray	Spray
July	No-spray	Spray	Spray	Spray	Spray
August	No-spray	Spray	Spray	Spray	Spray
September	No-spray	Spray	Spray	Spray	Spray
October	No-spray	Spray	Spray	Spray	Spray

Table 7: 'No-spray' window sugarcane, region specific, Diuron/hexazinone products, pre-emergent 1.8 kg ac/ha application

	WET TROPICS	BURDEKIN/DRY	MARY/BURNETT	MACKAY/WHITSUNDAY	NSW
November	No-spray	Spray	No-spray	No-spray	No-spray
December	No-spray	No-spray	No-spray	No-spray	No-spray
January	No-spray	No-spray	No-spray	No-spray	No-spray
February	No-spray	No-spray	No-spray	No-spray	No-spray
March	No-spray	Spray	No-spray	No-spray	No-spray
April	No-spray	Spray	No-spray	No-spray	No-spray
May	No-spray	Spray	No-spray	No-spray	Spray
June	No-spray	Spray	Spray	Spray	Spray
July	No-spray	Spray	Spray	Spray	Spray
August	No-spray	Spray	Spray	Spray	Spray
September	No-spray	Spray	Spray	Spray	Spray
October	No-spray	Spray	Spray	Spray	Spray

Table 8: 'No-spray' window sugarcane, region specific, Diuron/hexazinone products, post-emergent 1.8 kg ac/ha application, 60% band spray

	WET TROPICS	BURDEKIN/DRY	MARY/BURNETT	MACKAY/WHITSUNDAY	NSW
November	No-spray	Spray	No-spray	Spray	No-spray
December	No-spray	No-spray	No-spray	No-spray	No-spray
January	No-spray	No-spray	No-spray	No-spray	No-spray
February	No-spray	No-spray	No-spray	No-spray	No-spray
March	No-spray	Spray	Spray	No-spray	No-spray
April	No-spray	Spray	Spray	No-spray	Spray
May	No-spray	Spray	Spray	No-spray	Spray
June	No-spray	Spray	Spray	Spray	Spray
July	No-spray	Spray	Spray	Spray	Spray
August	No-spray	Spray	Spray	Spray	Spray
September	No-spray	Spray	Spray	Spray	Spray
October	No-spray	Spray	Spray	Spray	Spray

As this assessment shows, the risks between geographical sugar regions in Queensland (Wet Tropics, Burdekin Dry Tropics, Mackay/Whitsunday, Mary/Burnett) and New South Wales differs significantly. In addition, the results differ for the diuron-only products compared to the diuron/hexazinone products. Separate recommendations have been made to accommodate these differences. Under all use scenarios, the use of diuron in the Wet Tropics is unacceptable all year round and cannot be supported.

If a single window of application were to apply across all regions (apart from the Wet Tropics) the assessment shows the risks would only be acceptable if diuron application were restricted from to 1 June to 30 October each year. This would not make diuron a chemical option in sugarcane.

The diuron post-emergent application has been modelled at either 85% or 60% band spray which influences the likely runoff risk. Although the actual amount of area sprayed by post-emergent applications is likely to be highly variable, the APVMA has based the decision on post-emergent application 60% band spray. An appropriate statement has been included on product labels. DO NOT apply to more than 60% of the crop area.

Spray window

For the purposes of determining appropriate spray windows for each region and each use pattern, the APVMA has consolidated the findings from both the registrants' 3-month approach and the month-by-month used for the canegrowers proposal.

It is noted that in some areas the results between assessments do not align. To determine an appropriate 'no-spray' window the following should be noted:

- an assessment of risks during an individual month will take priority over the 3-month grouped results

- where no individual month assessment has been undertaken (for example, in the Canegrowers' proposed no-spray time of January, February and March) the 3-month grouped results (Nov–Jan, Feb–Mar) take priority.

There is an anomaly in the information where the risks in New South Wales show acceptable risk from a specific monthly assessment in October but an unacceptable risk in September using grouped results as no individual assessment of September was undertaken. This grouped result would have included the rainfall from November, making the risk higher. For this period it has been assumed the risk is acceptable.

It should also be noted that while the risks within the Burdekin are acceptable at certain times of the year, this is based on the rainfall-related runoff and does not account for irrigation, which can be significant in this region.

The results of this consolidation are as follows:

Sugarcane (diuron-only products)

DO NOT APPLY in the Wet Tropics

Pre-emergent use (max 1.8 kg ac/ha):

DO NOT APPLY in the Burdekin between 1 December and 29 February

DO NOT APPLY in Mackay/Whitsunday between 1 November and 31 May

DO NOT APPLY in Mary/Burnett between 1 November and 31 May

DO NOT APPLY in NSW between 1 November and 30 April

Post-emergent application (60% band spray)

DO NOT APPLY in the Burdekin between 1 January and 29 February

DO NOT APPLY in Mackay/Whitsunday between 1 December and 30 April

DO NOT APPLY in Mary/Burnett between 1 November and 29 February

DO NOT APPLY in NSW between 1 November and 30 April

Sugarcane (diuron/hexazinone products)

DO NOT APPLY in the Wet Tropics

Pre-emergent use (max 1.8 kg ac/ha):

DO NOT APPLY in Mackay/Whitsunday between 1 November and 31 May

DO NOT APPLY in Mary/Burnett between 1 November and 31 May

DO NOT APPLY in NSW between 1 November and 30 April

DO NOT APPLY in the Burdekin between 1 December and29 February

Post-emergent application (60% band spray)

DO NOT APPLY in the Burdekin between 1 January and 29 February

DO NOT APPLY in Mackay/Whitsunday between 1 November and 31 May

DO NOT APPLY in Mary/Burnett between 1 November and 29 February

DO NOT APPLY in NSW between 1 November and 31 March

DO NOT APPLY in the Burdekin between 1 December and 29 February

This is a very complex regime of use and while it allows for the continued use of diuron in sugarcane in certain areas, the success of these measures relies on the support of state authorities in the management of control of use activities.

In light of the pivotal role that state-based agencies will play in risk mitigation, the APVMA wrote to the Queensland Department of Agriculture, Fisheries and Forestry, asking for their assurance that the complex risk mitigation measures proposed to limit the environmental exposure from diuron as outlined above—specifically a regionally-derived no-spray window—can be enforced.

The advice received from the Qld authorities was that such a mitigating measure could be enforced. This would be made easier if there were record keeping requirements on product labels. These have been included. It is important to note that if results from future monitoring programs continue to show levels of diuron at environmentally-harmful levels, the APVMA may need to reconsider the use of diuron.

It should be noted that use of diuron at lower rates, up to a maximum rate of application of 450 g ac/ha when used in combination with paraquat, can be supported at all times of the year and in all regions without the need for the no-spray window (see APVMA 2012).

Instructions on labels for diuron use in sugarcane are varied. Some contain higher rates together with rates that include 1.8 kg ac/ha while others just have the high rates. In the 'high rate only' situations, continued use in sugarcane cannot be supported, as the rates of applications are above the acceptable maximum rate of 1.8 kg ac/ha.

5.2 DuPont Krovar DF Herbicide (31253)

The product *DuPont Krovar DF Herbicide (31253)* contains diuron at only 400 g/kg and is co-formulated with bromacil (400 g/kg). The use of this product is approved for use in only citrus and pineapples.

The September 2012 assessment did not specifically address this type of product formulation and as such an additional assessment was undertaken. A summary of this assessment follows with the full assessment provided in Appendix C.

DSEWPaC has no data for bromacil presently in its data holdings, as this active constituent has not been subject to an environmental risk assessment in Australia. However, it has been the subject of a reregistration assessment by the US EPA. In the US EPA Reregistration Eligibility Decision (RED, 1996) it reports that bromacil is a mobile and persistent herbicide with half-lives in the field exceeding 100 days.

To account for the uncertainties posed by bromacil, the risk assessment was based on an acceptable risk quotient of 0.5 or less. The 2012 assessment used an acceptable risk of 1.0 for diuron-only products and 0.8 for diuron/hexazinone combination products. Using this approach, the risks in citrus and pineapples were assessed.

Citrus

Application rates for citrus are 2.2 kg product to 4.5 kg product/ha, or 880 g diuron/ha to 1800 g diuron/ha. For diuron-only products, band spraying in Autumn and Spring resulted in an effective rate of 900 g ac/ha. In the case of *Krovar DF Herbicide*, up to half this rate may be used due to inter-row spraying (440 g ac/ha).

However, the additional influence of bromacil in this formulation needs to be considered, and the combined rate of the two active constituents would still remain at 880 g/ha for inter-row spraying, which is essentially the same as the rate considered for diuron alone in APVMA (2012). The diuron rates and application instructions reflect those already assessed in APVMA (2012). Consequently, no further refinement was undertaken and the conclusions from APVMA (2012) with respect to citrus remain.

Pineapples

Additional information in relation to expected timing of application was received by the APVMA from representatives of the pineapple industry and was considered in this assessment.

The main planting window for pineapples runs from March to November, with peak times from March to April and from late October to early December. This would cover 90% or more of plantings in a normal rainfall event year. With respect to the percentage of coverage in an inter-row spraying scenario, a 60% band spray would be appropriate, with as low as 40% achievable in some circumstances.

The consideration of the pineapple use pattern also included an assessment of a no-spray window to determine the likely risk of runoff during the main periods of application.

For the purposes of assessing the use of diuron in pineapples, the APVMA considered the following rates of application as per the label instruction:

- pre-emergent application of 4.5 kg product/ha (blanket spray 100% coverage)
- post-emergent application of 4.5 kg product/ha (85% and 60% coverage)
- post-emergent application of 2.2 kg product/ha (85% and 60% coverage).

Again in the assessment of post-emergent uses, 85% and 60% coverage rates were modelled. For the purposes of regulatory decisions, the APVMA chose to adopt the assumption of a maximum 60% band spray which as indicated above, can be applied within the pineapple production system.

The assessment was broken down further, according to region and as per the sugarcane assessment with the results outlined in Table 9, Table 10 and Table 11 below.

Table 9: 'No-spray' window pineapples, region specific, DuPont Krovar DF Herbicide, pre-emergent 4.5 kg product/ha application

	WET TROPICS	BURDEKIN/DRY	MARY/BURNETT	MACKAY/WHITSUNDAY	SOUTH EAST QLD
November	No-spray	Spray	Spray	Spray	No-spray
December	No-spray	No-spray	No-spray	No-spray	No-spray
January	No-spray	No-spray	No-spray	No-spray	No-spray
February	No-spray	No-spray	No-spray	No-spray	No-spray
March	No-spray	Spray	No-spray	No-spray	No-spray
April	No-spray	Spray	No-spray	No-spray	No-spray
May	No-spray	Spray	No-spray	No-spray	No-spray
June	No-spray	Spray	Spray	Spray	Spray
July	No-spray	Spray	Spray	Spray	Spray
August	No-spray	Spray	Spray	Spray	Spray
September	No-spray	Spray	Spray	Spray	No-spray
October	No-spray	Spray	Spray	Spray	No-spray

Table 10: 'No-spray' window pineapples, region specific, DuPont Krovar DF Herbicide, post-emergent application 4.5 kg product/ha, 60% band spray

	WET TROPICS	BURDEKIN/DRY	MARY/BURNETT	MACKAY/WHITSUNDAY	SOUTH EAST QLD
November	No-spray	Spray	Spray	Spray	No-spray
December	No-spray	No-spray	No-spray	No-spray	No-spray
January	No-spray	No-spray	No-spray	No-spray	No-spray
February	No-spray	No-spray	No-spray	No-spray	No-spray
March	No-spray	Spray	No-spray	No-spray	No-spray
April	No-spray	Spray	No-spray	No-spray	No-spray
May	No-spray	Spray	No-spray	No-spray	No-spray
June	No-spray	Spray	Spray	Spray	Spray
July	No-spray	Spray	Spray	Spray	Spray
August	No-spray	Spray	Spray	Spray	Spray
September	No-spray	Spray	Spray	Spray	No-spray
October	No-spray	Spray	Spray	Spray	No-spray

Table 11: 'No-spray' window pineapples, region specific, DuPont Krovar DF Herbicide, post-emergent application 2.2 kg product/ha, 60% band spray

	WET TROPICS	BURDEKIN/DRY	MARY/BURNETT	MACKAY/WHITSUNDAY	SOUTH EAST QLD
November	**No-spray**	**Spray**	**Spray**	**Spray**	**Spray**
December	**No-spray**	**No-spray**	**No-spray**	**No-spray**	**No-spray**
January	**No-spray**	**No-spray**	**No-spray**	**No-spray**	**No-spray**
February	**No-spray**	**No-spray**	**No-spray**	**No-spray**	**No-spray**
March	**No-spray**	**Spray**	**Spray**	**No-spray**	**No-spray**
April	**No-spray**	**Spray**	**Spray**	**No-spray**	**No-spray**
May	**No-spray**	**Spray**	**Spray**	**No-spray**	**No-spray**
June	**No-spray**	**Spray**	**Spray**	**Spray**	**Spray**
July	**No-spray**	**Spray**	**Spray**	**Spray**	**Spray**
August	**No-spray**	**Spray**	**Spray**	**Spray**	**Spray**
September	**No-spray**	**Spray**	**Spray**	**Spray**	**Spray**
October	**No-spray**	**Spray**	**Spray**	**Spray**	**Spray**

As in the sugarcane assessment, use cannot be supported at any time of the year in the Wet Tropics. Neither pre-emergent nor the higher rate of application (4.5 kg product/ha) can be supported in South East Queensland, as the no-spray window includes the main periods of use of diuron in pineapples.

If a single window of application across all areas were applied, it would run from 1 September to 31 May. However, with the support of state regulators, the APVMA has recommended the following regionally-based application windows for the use of the *DuPont Krovar DF Herbicide (31253)* in pineapples are as follows:

No-spray pineapples

DO NOT APPLY in the Wet Tropics

Pre-emergent application (4.5 kg product/ha)

DO NOT APPLY in the Burdekin between 1 December and 29 February

DO NOT APPLY in Mackay/Whitsunday between 1 December and 31 May

DO NOT APPLY in Mary/Burnett between 1 December and 31 May

DO NOT APPLY in South East Queensland between 1 June and 30 August

Post-emergent application (4.5 kg product /ha 60% band spray)

APPLY ONLY as a directed band spray over a maximum of 60% of the crop area

DO NOT APPLY in the Burdekin between 1 December and 29 February

DO NOT APPLY in Mackay/Whitsunday between 1 December and 31 May

DO NOT APPLY in Mary/Burnett between 1 December and 31 May

DO NOT APPLY in South East Queensland between 1 June and 30 August

Post-emergent (2.2 kg product/ha 60% band spray)

APPLY ONLY as a directed band spray over a maximum of 60% of the crop area

DO NOT APPLY in the Burdekin between 1 December and 29 February

DO NOT APPLY in Mary/Burnett between 1 December and 29 February

DO NOT APPLY in Mackay/Whitsunday between 1 December and 31 May

DO NOT APPLY in South East Queensland between 1 December and 31 May

Cotton

Following the release of the 2012 report, the APVMA met with individual registrants to discuss the proposed recommendations. At this meeting it was identified that while the DSEWPaC report (2012) recommended continued use in irrigated cotton if all tailwater was captured, and use in dryland cotton where at least 25 mm of rainfall could be held on farm, the recommendation for dryland cotton was not translated into the recommendations for the review (see section 7, Review Findings Report, September 2012).

The APVMA has now revised the conclusions for cotton, allowing continued use in irrigated and dryland cotton in situations only where irrigation and/or rainfall can be captured on farm. This mitigation measure reduces the potential for runoff resulting in acceptable environmental risk. A label statement to this effect has been included on labels – *DO NOT USE in cotton UNLESS ALL irrigation tailwater and/or up to 25 mm rainfall can be captured and held on farm.*

Lucerne

The recommendations contained in the 2012 environmental assessment indicated that current label directions for use of diuron in lucerne (minimum 900 g ac/ha) were much greater than those currently in use across the industry. In fact rates, as low as 500 g ac/ha were reported as common practice. The APVMA received many submissions in support of the continued use of diuron in lucerne based on the actual use rates being far less than those currently specified on current labels.

The APVMA has in fact issued a minor use permit for the use of diuron in lucerne at rates of 500 g ac/ha. This has been in place for a number of years although the rates have never been translated on to labels.

On the basis of these submissions DSEWPaC considered lower rates of application as part of the September 2012 assessment. This assessment concluded that on the basis of environmental risks, the use of diuron in lucerne can be supported at rates up to 750 g ac/ha.

The APVMA notes that the supportable rates are outside the current ranges for which efficacy would have been demonstrated at the time of registration of these products. Registration of this rate as a label claim has not been approved to date. While registrants provided arguments in support of the efficacy concerns, it is not possible through the review process to recommend continued use of diuron in situations where the proposed rates of application are lower than current labels. The efficacy of this use pattern would need to be demonstrated through a registration application.

Therefore the recommendation to remove lucerne from the label still applies.

6 REVIEW OUTCOMES (NOVEMBER 2012)

Taking into consideration the finding of the September 2012 assessment and the assessment of additional information provided to the APVMA, the following uses of diuron are supported:

Table 12: Supported uses and comments

SUPPORTED USES
Asparagus – Victoria only (label statement)
Bananas – in combination with paraquat only (lower rate 250 g ac/ha to 450 g ac/ha)
Bore drains – with label restraints
Cotton – only when irrigation tailwater and/or up to 25 mm rainfall can be captured (label statement)
Faba beans – only post-sowing pre-emergent application (label statement)
Irrigation channels, drainage ditches – only where all water can be contained on farm (label statement)
Lupins – with label restraints
Pineapples – only when used according to *DuPont Krovar DF (31253)* label instructions and within the permitted window of application (label statement)
Pulses – only where no-till farming practices are utilised (label statement)
Sugarcane – maximum rate of application 1.8 kg ac/ha within the permitted window of application (label statement)
Summer fallows – with label restraints
Wheat, barley, oats, triticale, cereal rye – with label restraints

On the basis of the environmental assessment 2012, consideration of new information to the review and a revised assessment, the following uses appearing on diuron product labels are not supported.

Table 13: Unsupported uses and comments

UNSUPPORTED USES
Apples and pears (established at least 1 year)
Bananas – at rates other than those above
Citrus
Coffee
Driveways, paths, lanes, drains, ditches, fence lines, car parks, tennis courts
Duboisia
Factory sites, commercial and industrial areas
Lucerne (established for 1 year or more)
Non-crop areas
Ornamentals – daffodils, gladioli and tulips, lilium, iris
Pawpaws (not for use on trees under 9 months old)
Peas
Perennial grass and seed crops, phalaris and cocksfoot
Phalaris cultivars sirolan and sirosa
Pineapple – other than in accordance with DuPont Krovar DF Herbicide
Rights-of-way
Sugarcane – rates >1.8 kg ac/ha
Tea
Vineyards (vines older than 3 years)

Label restraints—All products

DO NOT use in water-logged areas

DO NOT apply if greater than 50 mm rainfall is expected within 3 days of application

DO NOT irrigate within 3 days of application

DO NOT apply to fields where the slope exceeds 3%

DO NOT spot spray greater than 5% of total farm area

DO NOT apply more than once per calendar year

Label restraints—Use-specific

Cotton

DO NOT USE in cotton **UNLESS ALL** irrigation tailwater and/ or up to 25 mm rainfall can be captured and held on farm

Pulse crops

DO NOT USE in pulse crops **UNLESS** application can be made using no-till farming practices

Irrigation channels and drains

DO NOT USE in irrigation channels or drains **UNLESS ALL** irrigation tailwater and rainfall can be captured and held on farm

Desert channels (bore drains)

DO NOT apply from 1 December to 30 March each year

DO NOT open drains for 72 hours following treatment

SPRAY DRIFT RESTRAINTS

DO NOT apply by air

DO NOT apply with spray droplets smaller than COARSE spray droplet size category according to nozzle manufacturer specifications that refer to the ASAE S572 Standard or the BCPC Guideline.

Users of this product MUST make an accurate written record of the details of each spray application within 24 hours following application and KEEP this record for a minimum of 2 years. The spray application details that must be recorded are:
1. Date with start and finish times of application;
2. Location address and paddock/s sprayed;
3. Full name of this product;
4. Amount of products used per hectare and number of hectares applied to;
5. Crop/situation and weed/pest;
6. Wind speed and direction during application;
7. Air temperature and relative humidity during application;
8. Nozzle brand, type, spray angle, nozzle capacity and spray system pressure measured during application;
9. Name and address of person applying this product.
(Additional record details many be required by the State or Territory where this product is used).

MANDATORY NO-SPRAY ZONES

DO NOT apply when there is non-target vegetation downwind from the application area and within the mandatory no-spray zones shown in table below.

DO NOT apply when there are aquatic and wetland areas including aquacultural ponds, surface streams and rivers downwind from the application area and within the mandatory no-spray zones shown in table 14 below.

Table 14: Downwind buffer zone

Situation	Rate ac/ha	Downwind buffer zone (m)	
		Aquatic	Terrestrial
Wheat, barley, triticale, cereal rye, oats (WA only)	250–500	30	60
Wheat, barley, triticale and oats (WA only)	180–250	15	30
Wheat, barley, oats (NSW, Vic, ACT, SA only)	450	25	50
Wheat and barley – SA only	640–880	50	100
Wheat and barley – NSW, Vic, ACT, SA only	250	15	30
Summer fallows – SA only	250	15	30
Cotton	900–1800	100	200
Lupins – WA only	990	30	80
Pulses – incorporated by sowing	750–990	30	80
Pulses – post-sowing pre-emergent	495–750	50	100
Sugarcane & bananas	250–450	25	50
Sugarcane	1800	100	200
Pineapples	1300	100	200
Asparagus	1800	100	200

Label restraints – no-spray windows

Sugarcane (diuron-only products)

DO NOT APPLY in the Wet Tropics

Pre-emergent use (max 1.8 kg ac/ha):

DO NOT APPLY in the Burdekin between 1 December and 29 February

DO NOT APPLY in Mackay/Whitsunday between 1 November and 31 May

DO NOT APPLY in Mary/Burnett between 1 November and 31 May

DO NOT APPLY in NSW between 1 November and 30 April

Post-emergent application (60% band spray)

APPLY ONLY as a directed band spray over a maximum of 60%of the crop area

DO NOT APPLY in the Burdekin between 1 January and 29 February

DO NOT APPLY in Mackay/Whitsunday between 1 December and 30 April

DO NOT APPLY in Mary/Burnett between 1 November and 29 February

DO NOT APPLY in NSW between 1 November and 30 April

Sugarcane (diuron/hexazinone products)

DO NOT APPLY in the Wet Tropics

Pre-emergent use (max 1.8 kg ac/ha):

DO NOT APPLY in Mackay/Whitsunday between 1 November and 31 May

DO NOT APPLY in Mary/Burnett between 1 November and 31 May

DO NOT APPLY in NSW between 1 November and 30 April

DO NOT APPLY in the Burdekin between 1 December between 29 February

Post-emergent application (60% band spray)

APPLY ONLY as a directed band spray over a maximum of 60%of the crop area

DO NOT APPLY in the Burdekin between 1 January and 29 February

DO NOT APPLY in Mackay/Whitsunday between 1 November and 31 May

DO NOT APPLY in Mary/Burnett between 1 November and 29 February

DO NOT APPLY in NSW between 1 November and 31 March

Pineapples (Du Pont Krovar DF Herbicide)

DO NOT APPLY in the Wet Tropics

Pre-emergent application (4.5 kg product/ha)

DO NOT APPLY in the Burdekin between 1 December and 29 February

DO NOT APPLY in Mackay/Whitsunday between 1 December and 31 May

DO NOT APPLY in Mary/Burnett between 1 December and 31 May

DO NOT APPLY in South East Queensland between 1 September and 31 May

Post-emergent application (4.5 kg product/ha 60% band spray)

APPLY ONLY as a directed band spray over a maximum of 60%of the crop area

DO NOT APPLY in the Burdekin between 1 December and 29 February

DO NOT APPLY in Mackay/Whitsunday between 1 December and31 May

DO NOT APPLY in Mary/Burnett between 1 December and31 May

DO NOT APPLY in South East Queensland between 1 September and 31 May

Post-emergent (2.2 kg product/ha 60% band spray)

APPLY ONLY as a directed band spray over a maximum of 60%of the crop area

DO NOT APPLY in the Burdekin between 1 December and 29 February

DO NOT APPLY in Mary/Burnett between 1 December and 29 February

DO NOT APPLY in Mackay/Whitsunday between 1 December and 31 May

DO NOT APPLY in South East Queensland between 1 December and 31 May

Label approval numbers

The APVMA has now VARIED product labels to uniquely identify the labels resulting from this review. The new number is [product_number]/1112.

7 REGULATORY DECISIONS

On the basis of the evaluation of the submitted data and information (including protected information), the APVMA has made the following regulatory decisions in relation to the continued registration and approval of diuron use in Australia:

1. Revoke current suspensions.
2. Cancel product registrations.
3. Vary conditions of label approval.
4. Affirm product registrations.
5. Cancel label approvals.

7.1 Revoke current suspensions of diuron products and label approvals

In order to apply the review findings, the APVMA has revoked the suspensions of the products and associated label approvals listed in Appendix A.

7.2 Cancellations of registrations and label approvals

This action relates to the products listed in Table A-1 of Appendix A.

The APVMA is NOT SATISFIED that the labels for selected products listed in Table A-1 Appendix A contain adequate instructions in relation to the criteria set out in s.14(3)(g) of the Agvet Codes. The APVMA is NOT SATISFIED that the relevant particulars of approval of these labels can be varied in such a way that the requirements for continued registration will be complied with.

On this basis, the APVMA is NOT SATISFIED that continued registration of the products in accordance with its instructions for use would not be likely to have an unintended effect that is harmful to animals, plants or things or to the environment.

The registrations of these products and associated labels have been CANCELLED.

7.3 Vary conditions of label approval

This action relates to those products where one or more uses on product labels are supported, as listed in Table A-2 of Appendix A.

The APVMA is NOT SATISFIED that labels for selected products contain adequate instructions in relation to the criteria set out in s.14(3)(g) of the Agvet Codes.

However, the APVMA IS SATISFIED the relevant particulars approval can be VARIED, in accordance with s.34(5) of the Agvet Codes.

The APVMA has now VARIED the labels (Column D Table A-2, Appendix A), removing those uses appearing in Table 9 above of this report and adding the label restraints and buffer zones, also found in Section 6.

7.4 Affirm product registration and label approval

The label variations are now made and the APVMA is SATISFIED that labels contain adequate instructions.

On this basis, the APVMA is SATISFIED that continued registration of the products listed in Table A-2 of Appendix A in accordance with their instructions for use:

- would not be likely to have an effect that is harmful to human beings
- would not be likely to have an unintended effect that is harmful to animals, plants or things or to the environment.

The APVMA has AFFIRMED the registration of products in Table A-2 of Appendix A on this basis.

7.5 Cancellation of all but the most recently approved label

The APVMA is NOT SATISFIED that previously approved product labels for currently-registered products included in the review as well as subject to the outcomes of the review listed in Column F of Table A-2 contain adequate instructions in relation to the criteria set out in s.14(3)(g) of the Agvet Codes. On this basis, these labels have been CANCELLED.

7.6 Phase-out periods

The APVMA has determined that a period of 12 months applies to the supply and use of cancelled product or the supply and use of product bearing either a cancelled or varied label. The APVMA has issued a permit for this phase-out in accordance with the current suspension instructions. These new instructions are a combination of those issued at the time of the diuron suspension, and those contained in this report.

REFERENCES

APVMA, 2011. Diuron Environment Assessment. Australian Pesticides and Veterinary Medicines Authority. July 2011. www.apvma.gov.au/products/review/docs/diuron_environment.pdf

APVMA, 2012. Diuron Review Findings Report. The reconsideration of the registrations of selected products containing diuron and their associated labels. Australian Pesticides and Veterinary Medicines Authority. September 2012. www.apvma.gov.au/products/review/docs/diuron_review_report.pdf

ABBREVIATIONS

TIME		WEIGHT	
d	day	bw	body weight
h	hour	g	gram
min	minute	Kg	kilogram
mo	month	µg	microgram
wk	week	mg	milligram
yr	year	wt	weight
LENGTH			
cm	centimetre		
m	metre	Concentration	
mm	millimetre	ppb	Parts per billion
		ppm	Parts per million
VOLUME			
L	litre		
mL	millilitre		
µL ML	microliter megaliter		
ha	hectare		
TERMINOLOGY			
ac	active constituent		
ADI	acceptable daily intake		
ARfD	acute reference dose		
DF	dry flowables		
DT50	time for 50% of the substance to dissipate		
E_bC50	concentration of a test substance resulting in a 50% inhibition of biomass in an algal test		
EC25	concentration of a test substance resulting in an effect on 25% of the test species		
EC50	concentration of a test substance resulting in an effect on 50% of the test species		
E_rC50	concentration of a test substance resulting in a 50% inhibition of growth rate in an algal test		
G	granules		

TIME		WEIGHT	
GLP	good laboratory practice		
Kd	soil sorption constant		
Koc	soil sorption / desorption coefficient, normalised to organic carbon content		
LC50	concentration (e.g. in water, food or soil) resulting in a 50% mortality of the test organism		
LD50	dose (oral) resulting in a 50% mortality of the test organism		
LOD	limit of detection		
LOEC	lowest observed effect concentration (i.e. the test concentration at which some effect occurs)		
LOEL	lowest observed effect level		
LOQ	limit of quantification		
NOAEL	no observed adverse effect level		
NOEC	no observed effect concentration (i.e. the test concentration at which no effect is observed)		
NOEL	no observed effect level		
OP	organophosphorus pesticide		
SC	suspension concentrates		
SP	soluble powders		
SSD	species sensitivity distribution		
WG	water-dispersible granules		
WP	wettable powders		

ORGANISATIONS AND PUBLICATIONS	
APVMA	Australian Pesticides and Veterinary Medicines Authority
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (previously the Department of the Environment and Heritage)
FAO	Food and Agriculture Organization of the United Nations
GBR	Great Barrier Reef
JMPR	Joint Meeting on Pesticide Residues
NRA	National Registration Authority for Agricultural and Veterinary Chemicals
OCS	Office of Chemical Safety
OECD	Organisation for Economic Co-operation and Development

TIME		WEIGHT	
PRF	Preliminary Review Findings		
SUSDP	Standard for the Uniform Scheduling of Drugs and Poisons		
US EPA	United States Environmental Protection Agency		
WHO	World Health Organization		

Appendix A: Products included in the review and regulatory outcomes

Product registrations

Table 1: Product registrations to be cancelled

PRODUCT NUMBER	PRODUCT NAME	REGISTRANT	LABEL APPROVALS CANCELLED
31275	Agspray Kill-All Total Herbicide	Agspray Chemical Co. Pty Ltd	31275/50432
45441	Macspred Dymac G Granular Herbicide	Macspred Pty Ltd	45441/02
47764	Macspred Kromac Industrial Herbicide	Macspred Pty Ltd	47764/02

Table 2: Variations

COLUMN A PRODUCT NUMBER	COLUMN B PRODUCT NAME	COLUMN C REGISTRANT	COLUMN D LABEL APPROVALS VARIED	COLUMN E NEW LABEL APPROVAL	COLUMN F LABEL APPROVALS CANCELLED
31253	Dupont Krovar DF Herbicide	Du Pont (Australia) Ltd	31253/4732	45909/1112	31253/01 31253/0310
31682	Agspray Die-It 800 Wettable Powder Diuron Herbicide	Agspray Chemical Co. Pty Ltd	31275/50432	45909/1112	–
31685	Bayer Diuron 500 SC Liquid Herbicide	Lanxess Pty Ltd	31685/1103	31685/1112	31685/0399
31702	Nufarm Flowable Diuron Liquid Herbicide	Nufarm Australia Ltd	31702/1007	31702/1112	31702/0200 31702/0605
39201	Nufarm Diuron 900 DF Herbicide	Nufarm Australia Ltd	39201/0507	39201/1112	39201/1298 39201/0499 39201/0802 39201/0605
45177	Bayer Diuron 900 WG Herbicide	Lanxess Pty Ltd	45177/0204	45177/1112	45177/03
45772	Diurex WG Herbicide	Crop Care Australasia Pty Ltd	45772/1107	45772/1112	45772/1098 45772/0101
45909	Dupont Velpar K4 DF Herbicide	Du Pont (Australia) Ltd	45909/0506	45909/1112	45909/02

COLUMN A PRODUCT NUMBER	COLUMN B PRODUCT NAME	COLUMN C REGISTRANT	COLUMN D LABEL APPROVALS VARIED	COLUMN E NEW LABEL APPROVAL	COLUMN F LABEL APPROVALS CANCELLED
46812	Farmoz Diuron 900 WDG Herbicide	Farmoz Pty Ltd	46812/0807	46812/1112	46812/02 46812/0207 46812/0305
47661	Striker 500 SC Selective Herbicide by Sanonda	Sanonda (Australia) Pty Ltd	47661/02	47661/1112	–
48974	Zee-Uron 800 WP Herbicide	United Phosphorus Ltd	48974/01	48974/1112	–
49540	Zee-Uron 500 SC Herbicide	United Phosphorus Ltd	49540/0705	49540/1112	49540/01
49541	Zee-Uron 900 WG Herbicide	United Phosphorus Ltd	49541/0508	49541/1112	49541/01 49541/0108
50481	Agcare Biotech Flowable Diuron 500 SC Herbicide	Agcare Biotech Pty Ltd	50481/0398	50481/1112	–
52176	Farmoz Diuron 500 Flowable Herbicide	Farmoz Pty Ltd	52176/1106	52176/1112	52176/0100 52176/0305
52342	Chemag Diuron Liquid Herbicide	Imtrade Australia Pty Ltd	52342/0100	52342/1112	–
52672	Sipcam Diuron 500 SC Herbicide	Sipcam Pacific Australia Pty Ltd	52672/0800	52672/1112	52672/0200
53046	Smart Diuron 500 Flowable Liquid Herbicide	Agcare Biotech Pty Ltd	53046/0600	53046/1112	–
53812	Imtrade Diuron 900 WG Herbicide	Imtrade Australia Pty Ltd	53812/52842	53812/1112	53812/0901
54182	Agricultural Product Services Diuron/Hexazinone DF Herbicide	Agricultural Product Services Pty Ltd	54182/0501	45909/1112	–
55094	Country Diuron 900 WG Herbicide	Accensi Pty Ltd	55094/0102	55094/1112	–
55561	Conquest Diuron 900 WG Herbicide	Conquest Crop Protection Pty Ltd	55561/0106	55561/111	55561/0302
55612	Kenso Agcare Diuron 500 Herbicide	Kenso Corporation (M) SDN BHD	55612/0402	55612/1112	–

COLUMN A PRODUCT NUMBER	COLUMN B PRODUCT NAME	COLUMN C REGISTRANT	COLUMN D LABEL APPROVALS VARIED	COLUMN E NEW LABEL APPROVAL	COLUMN F LABEL APPROVALS CANCELLED
56349	4 Farmers Diuron 500 SC Liquid Herbicide	4 Farmers Pty Ltd	56349/0204	56349/1112	56349/1002
56356	4Farmers Diuron 900 DF Herbicide	4 Farmers Pty Ltd	56356/1207	56356/1112	56356/0405
56602	Halley Diuron 500SC Herbicide	Halley International Enterprise (Australia) Pty Ltd	56602/0603	56602/1112	–
57823	Echem Diuron 500 SC Herbicide	Echem (Aust) Pty Limited	57823/0204	57823/1112	–
57886	Summit Diuron 900WG Herbicide	Sipcam Pacific Australia Pty Ltd	57886/0306	57886/1112	57886/1003
57934	Runge Agrichems Diuron 900 WG Herbicide	Runge Agrichems Pty Ltd	57934/0104	57934/1112	–
58128	4Farmers Diuron/Hexazinone WG Herbicide	4Farmers Pty Ltd	58128/1103	58128/1112	–
58440	Ospray Diuron 500 Flowable Herbicide	Ospray Pty Ltd	58440/1206	58440/1112	58440/0304
58451	Ospray Diuron 900 WG Herbicide	Ospray Pty Ltd	58451/0406	58451/1112	58451/0304
58455	United Farmers Diuron 900 WG Herbicide	Ravensdown Fertiliser Cooperative Limited	58455/0305	58455/1112	58455/0204
59463	Chemag Diuron/Hexazinone WG Herbicide	Imtrade Australia Pty Ltd	59463/0805	59463/1112	–
59557	Barrage Herbicide	Crop Care Australasia Pty Ltd	59557/0105	59557/1112	–
60152	Agroreg Diuron 900 WG Herbicide	OzCrop Pty. Ltd	60152/0309	60152/1112	60152/0106
60286	Genfarm Diuron 900WG Herbicide	Landmark Operations Limited	60286/1109	60286/1112	60286/1008
60768	Farmoz Bobcat Combi WG Herbicice	Farmoz Pty Limited	60768/51116	60768/1112	60768/0806
60926	Whitestar Hexon 900 WG Herbicide	Agricultural Product Services Pty Ltd	60926/0506	60926/1112	–

COLUMN A PRODUCT NUMBER	COLUMN B PRODUCT NAME	COLUMN C REGISTRANT	COLUMN D LABEL APPROVALS VARIED	COLUMN E NEW LABEL APPROVAL	COLUMN F LABEL APPROVALS CANCELLED
61309	CMS Diuron 900 WG Herbicide	CMS Trade Pty Ltd	61309/0309	61309/1112	61309/0906
62012	Generex Sugarhex Herbicide	Macspread Pty Ltd	62012/0707	62012/1112	–
62189	Titan Diuron 900 WG Herbicide	Titan Ag Pty Ltd	62189/1207	62189/1112	62189/1108
62426	Chemforce Diuron 900WG Herbicide	Chemforce 2010 Pty Ltd	62426/1007	62426/1112	–
62700	Ozcrop Diuron 900 WG Herbicide	CMS Trade Pty Ltd	62700/0309	62700/1112	62700/0108
62797	Grandpar K4 Cane Herbicide	Sipcam Pacific Australia Pty Ltd	62797/0508	62797/1112	–
63571	United Phosphorus Zee-Uron 900 WG Herbicide	United Phosphorus Ltd	63571/1108	63571/1112	63571/11008
63621	Country Diuron 500SC Herbicide	Accensi Pty Ltd	63621/1108	63621/1112	–
63917	Rygel Dihex 900 WG Herbicide	ProFeng Australia Pty Ltd	63917/0409	63917/1112	–
64301	Imtrade Velchem Dust Herbicide	Imtrade Australia Pty Ltd	64301/0909	64301/1112	–
64359	Farmalinx Diuron 900 WG Herbicide	Farmalinx Pty Ltd	64359/52352	64359/1112	64359/0610
64727	Agriron 900 WG Herbicide	Agri Environmental Pty Ltd	64727/0610	64727/1112	–
65037	AC Vertex Herbicide	Axichem Pty Ltd	65037/0710	65037/1112	–
65215	AW Dethrone Herbicide	Agri West Pty Limited	65215/50428	65215/1112	–
65501	Apparent Diuron 900 WG Herbicide	Apparent Pty Ltd	65501/51062	65501/1112	–
65536	Sanonda Herbicide Diuron 900WG	Sanonda (Australia) Pty Ltd	65536/51149	65536/1112	–
65562	Choice Diuhex Cane Herbicide	Grow Choice Pty Limited	65562/51292	65562/1112	–
66184	Apparent Diuron 500 ISC Herbicide	Apparent Pty Ltd	66184/52944	66184/1112	–

COLUMN A PRODUCT NUMBER	COLUMN B PRODUCT NAME	COLUMN C REGISTRANT	COLUMN D LABEL APPROVALS VARIED	COLUMN E NEW LABEL APPROVAL	COLUMN F LABEL APPROVALS CANCELLED
66239	Rainbow Diuron 900 WG Herbicide	Shandong Rainbow International Co. Ltd	66239/53043	66239/1112	–
66261	AAKO Brave 60 WG-Herbicide	AAKO Australia Pty Limited	66261/53102	66261/1112	–
66636	Wynca Diuron 900 WG Herbicide	Zhejiang Xinan Chemical Industrial Group	66636/54065	66636/1112	–

Appendix B: DSEWPaC consideration of a no-spray window for sugarcane

Prepared by

Australian Government

Department of Sustainability, Environment, Water, Population and Communities

Environment Protection Branch

1 November 2012

Table of Contents

B1 INTRODUCTION 46
B2 REGISTRANT PROPOSED SPRAY WINDOW 46
B3 CANEGROWERS PROPOSED SPRAY WINDOW 57
B4. STATEMENT OF UNCERTAINTIES 65
B5. CONCLUSIONS 65
B6. REFERENCES 69
APPENDIX B1 – MAXIMUM ACCEPTABLE DAILY RAINFALL (RQ<1 IN STANDARD WATER BODY) 70
APPENDIX B2 – P(RF), P(RE) AND P(COM) VALUES, DECEMBER TO FEBRUARY 71
APPENDIX B3 – P(RF), P(RE) AND P(COM) VALUES, MARCH TO MAY 72
APPENDIX B4 – P(RF), P(RE) AND P(COM) VALUES, JUNE TO AUGUST 73
APPENDIX B5 – P(RF), P(RE) AND P(COM) VALUES, SEPTEMBER TO NOVEMBER 74
APPENDIX B6 – RAINFALL VALUES (MM/D) ASSOCIATED WITH P(COM) = 10% 75
APPENDIX B7 – MINIMUM STREAM FLOW (ML/D) FOR ACCEPTABLE IN-STREAM RISK QUOTIENT (RQ ≤1) 76
APPENDIX B8 –MONTHLY P(COM) VALUES FOR SUGAR GROWING REGIONS 78
APPENDIX B9 –RAINFALL VALUES FOR P(COM) = 10% (MONTHLY ANALYSIS) 79
APPENDIX B10 –MINIMUM FLOW RATES, ML/D FOR ACCEPTABLE IN-STREAM RISK QUOTIENT (RQ ≤1 - MONTHLY ANALYSIS) 80
C1. INTRODUCTION 83
C2. CONSIDERATION OF BROMACIL 83
C3. CITRUS 84
C4. PINEAPPLES 84
C5. CONCLUSIONS 94
C6. REFERENCES 96
APPENDIX C1 – MAXIMUM ACCEPTABLE DAILY RAINFALL (RQ<1 IN STANDARD WATER BODY) 97
APPENDIX C2 – P(RF), P(RE) AND P(COM) VALUES, DECEMBER TO FEBRUARY 98
APPENDIX C3 – P(RF), P(RE) AND P(COM) VALUES, MARCH TO MAY 99
APPENDIX C4 – P(RF), P(RE) AND P(COM) VALUES, JUNE TO AUGUST 100
APPENDIX C5 – P(RF), P(RE) AND P(COM) VALUES, SEPTEMBER TO NOVEMBER 101
APPENDIX C6 – RAINFALL VALUES (MM/D) ASSOCIATED WITH P(COM) = 10% 102
APPENDIX C7 – MINIMUM STREAM FLOW (ML/D) FOR ACCEPTABLE IN-STREAM RISK QUOTIENT (RQ ≤1) 103

B1 Introduction

In September 2012 the APVMA published the Diuron Review Findings Report (APVMA, 2012). That report considered additional information provided in submissions received in response to APVMA (2011) and included the development of a runoff risk assessment framework to better address exposure through runoff for the different diuron registered uses.

One proposal put forward by registrants (Nufarm and Farmoz) was to apply a spray window to limit use of diuron for sugarcane to seasons where significant rainfall was unlikely, thereby reducing the overall chance of runoff events leading to diuron exposure in water ways. The proposed window for application was 1 May to 30 November (7 months). This mitigation option was not considered in APVMA (2012) due to a submission from end users (through Canegrowers) strongly opposing such a strategy, claiming this option was not manageable – see Section V2.11.7, APVMA (2012).

Despite this, and because this proposal was put forward in submissions underpinning the APVMA (2012) report, the use of a spray window to mitigate runoff risk associated with diuron use in sugarcane is being assessed in this addendum report. The assessment is only limited to rates at 1800 g ac/ha, applied either as a blanket spray (pre-emergence) or banded spray (post-emergence), as the next lowest registered rate of 450 g ac/ha (when tank mixed with paraquat) has already been supported.

Since that time, Canegrowers has advised in a letter to the APVMA of 16 October 2012 that they support a no-use window of 1 January to 31 March. In the diuron assessment, rainfall data were considered in three monthly blocks to ascertain acceptability within a particular time period of runoff risk. To assess the Canegrowers proposed window, rainfall data have been assessed on a monthly basis either side of their proposed window in order to determine whether such a window would be acceptable.

B2 Registrant proposed spray window

Label instructions for sugar cane are for both pre- and post-emergence. For pre-emergence application, the maximum rate of application adopted at the time of suspension was 1.8 kg ac/ha and has been used in this assessment. Soil surface must be moist at the time of application. Therefore, Scenario 1 will apply (bare soil; moist).

When used as a post-emergent herbicide, there would appear to be greater control and hence a decreased opportunity for runoff. Suspension instructions specified application as a directed spray to below cane leaves. This indicates less than the whole hectare will receive a treatment. Scenario (4) will be modelled (covered soil; moist). In line with methodology in APVMA (2012), this banded spray will be modelled at a range of 60% to 85% coverage of the 1800 g/ha rate resulting in total rates of 1080 g ac/ha and 1530 g ac/ha respectively.

B2.1 Tier 2 modelling – P(com) analysis

Modelling results for acceptable daily rainfall, rainfall probability (P(rf)), probability of exceeding the acceptable daily rainfall on wet days (P(re)), and P(com) values for all application scenarios are provided in Appendices 1 to 5. All modelling has been undertaken retaining the 3% slope restriction applied in APVMA (2012).

Not surprisingly, the highest P(com) values were associated with the wettest period (December to February) modelled. For all scenarios and in all catchments, P(com) exceeded the 10% trigger. Significantly reduced P(com) values were calculated for other (lower rainfall) periods, but the 10% trigger value was still continually exceeded in the Wet Tropics for all time periods modelled.

In the Burdekin Dry Tropics, P(com) was below the 10% trigger value for all application scenarios at all time periods except the December to February wet period.

In both the Mackay/Whitsunday and Mary/Burnett growing regions, all application scenarios were acceptable in terms of P(com) for June through to the end of November. In the March to May time period, P(com) exceeded the 10% trigger in the Mackay/Whitsunday while only the highest pre-emergent situation was unacceptable in the Mary/Burnett based on P(com).

Rainfall characteristics in the NSW sugar growing region were such that for March to May, only the lowest application rate at 60% coverage appeared acceptable based on P(com), while for the June to August period, all application scenarios were acceptable. In the September to November time period, post-emergence application at both 85% and 60% coverage was acceptable based on P(com).

B2.2 Tier 3 modelling – In-Stream analysis

It was demonstrated in APVMA (2012) that at the 90th percent flow rate seldom resulted in in-stream risk quotients exceeding a value of 1. Therefore, this analysis will be restricted to the 75th and 25th percentile flow rates.

In order to undertake the in-stream analysis, rainfall values associated with a P(com) = 10% are required as these are associated with 25th percentile stream flow rates. These values have been calculated from various weather stations in the different growing regions based on long term daily rainfall data and are provided in Appendix 6. Using these data, a minimum acceptable daily flow rate is calculated for the different growing regions at which point the in-stream predicted concentration becomes acceptable. These minimum daily flow rates are provided in Appendix 7.

It is recognised that the streamflow monitoring data do not represent the full range of streamflows available for catchments as time did not permit such an approach. While an effort was made in selecting gauge stations to provide a large range of river and stream sizes, the selection process necessarily was targeted at smaller streams to better predict in-stream concentrations for those more likely to be at risk. This means that generally, results are skewed towards lower stream flows.

B.2.2.1 Wet Tropics

The following tables provide in-stream risk quotients for stream flow data obtained in the use region as described in Table V2.80 in APVMA (2012). Shaded cells indicate cases where the in-stream risk quotients exceed the level of concern of 1.0.

Table B1: In-Stream Risk Quotients, Wet Tropics, December to February

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha) 1800	1530	1080
108002A	315	0.3	0.2	0.1
108007A	57	1.4	0.8	0.6
108008A	19	4.3	2.5	1.8
109001A	265	0.3	0.2	0.1
110020A	198	0.4	0.2	0.2
110011B	22	3.7	2.2	1.5
110104A	28	2.9	1.7	1.2
110018A	19	4.3	2.5	1.8
110022A	29	2.8	1.7	1.2
111005A	344	0.2	0.1	0.1
111009A	7	11.6	6.9	4.8
111010B	14	5.8	3.4	2.4
111101D	690	0.1	0.1	0.05
113004A	130	0.6	0.4	0.3
113006A	2787	0.03	0.02	0.01
113007A	34	2.4	1.4	1.0
112003A	149	0.5	0.3	0.2
112002A	24	3.4	2.0	1.4
112104A	9	9.0	5.3	3.8
112101B	704	0.1	0.1	0.05
112102A	120	0.7	0.4	0.3
116014A	25	3.2	1.9	1.4
116013A	62	1.3	0.8	0.5
116008B	54	1.5	0.9	0.6
116006B	450	0.2	0.1	0.1
116017A	10	8.1	4.8	3.4

Table B2: In-Stream Risk Quotients, Wet Tropics, March to May

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha) 1800	1530	1080
108002A	315	0.2	0.1	0.1
108007A	57	1.4	0.8	0.6
108008A	19	4.1	2.4	1.7
109001A	265	0.3	0.2	0.1
110020A	198	0.4	0.2	0.2
110011B	22	3.5	2.1	1.5
110104A	28	2.8	1.6	1.2
110018A	19	4.1	2.4	1.7
110022A	29	2.7	1.6	1.1
111005A	344	0.2	0.1	0.1
111009A	7	11.1	6.5	4.6
111010B	14	5.5	3.3	2.3
111101D	690	0.1	0.1	0.05
113004A	130	0.6	0.4	0.2
113006A	2787	0.03	0.02	0.01
113007A	34	2.3	1.3	1.0
112003A	149	0.5	0.3	0.2
112002A	24	3.2	1.9	1.3
112104A	9	8.6	5.1	3.6
112101B	704	0.1	0.1	0.05
112102A	120	0.6	0.4	0.3
116014A	25	3.1	1.8	1.3
116013A	62	1.3	0.7	0.5
116008B	54	1.4	0.8	0.6
116006B	450	0.2	0.1	0.1
116017A	10	7.8	4.6	3.2

Table B3: In-Stream Risk Quotients, Wet Tropics, June to August

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha)		
		1800	1530	1080
108002A	315	0.1	0.1	0.05
108007A	57	0.6	0.4	0.3
108008A	19	1.9	1.1	0.8
109001A	265	0.1	0.1	0.1
110020A	198	0.2	0.1	0.1
110011B	22	1.6	0.9	0.7
110104A	28	1.3	0.7	0.5
110018A	19	1.9	1.1	0.8
110022A	29	1.2	0.7	0.5
111005A	344	0.1	0.1	0.04
111009A	7	5.2	3.0	2.1
111010B	14	2.6	1.5	1.0
111101D	690	0.1	0.03	0.02
113004A	130	0.3	0.2	0.1
113006A	2787	0.01	0.01	0.01
113007A	34	1.1	0.6	0.4
112003A	149	0.2	0.1	0.1
112002A	24	1.5	0.9	0.6
112104A	9	4.0	2.3	1.6
112101B	704	0.1	0.03	0.02
112102A	120	0.3	0.2	0.1
116014A	25	1.4	0.8	0.6
116013A	62	0.6	0.3	0.2
116008B	54	0.7	0.4	0.3
116006B	450	0.1	0.05	0.03
116017A	10	3.6	2.1	1.5

Table B4: In-Stream Risk Quotients, Wet Tropics, September to November

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha) 1800	1530	1080
108002A	315	0.1	0.05	0.04
108007A	57	0.5	0.3	0.2
108008A	19	1.4	0.8	0.6
109001A	265	0.1	0.1	0.04
110020A	198	0.1	0.1	0.1
110011B	22	1.3	0.7	0.5
110104A	28	1.0	0.6	0.4
110018A	19	1.4	0.8	0.6
110022A	29	0.9	0.5	0.4
111005A	344	0.1	0.05	0.03
111009A	7	3.9	2.2	1.6
111010B	14	2.0	1.1	0.8
111101D	690	0.04	0.02	0.02
113004A	130	0.2	0.1	0.1
113006A	2787	0.01	0.01	0.004
113007A	34	0.8	0.5	0.3
112003A	149	0.2	0.1	0.1
112002A	24	1.1	0.7	0.5
112104A	9	3.1	1.7	1.2
112101B	704	0.04	0.02	0.02
112102A	120	0.2	0.1	0.1
116014A	25	1.1	0.6	0.4
116013A	62	0.4	0.3	0.2
116008B	54	0.5	0.3	0.2
116006B	450	0.1	0.03	0.02
116017A	10	2.8	1.6	1.1

B 2.2.2 Burdekin Dry Tropics

The following tables provide in-stream risk quotients for stream flow data obtained in the use region as described in Table V2.88 in APVMA (2012). Shaded cells indicate cases where the in-stream risk quotients exceed the level of concern of 1.0.

Table B5: In-Stream Risk Quotients, Burdekin Dry Tropics, December to February

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha) 1800	1530	1080
120110A	97	0.6	0.3	0.2
120120A	27	2.2	1.3	0.9
120216A	14	4.2	2.4	1.7
120304A	21	2.8	1.6	1.1
120305A	16	3.7	2.1	1.5
120309A	25	2.3	1.4	1.0
120106B	18	3.3	1.9	1.3
120302B	50	1.2	0.7	0.5
119003A	63	0.9	0.5	0.4
119004A	12	4.9	2.8	2.0
119006A	38	1.5	0.9	0.6
119101A	26	2.3	1.3	0.9
119102A	39	1.5	0.9	0.6
119103A	12	4.9	2.8	2.0
119104A	13	4.5	2.6	1.8

For all other time periods, based on rainfall patterns and minimum flow requirements (<4.3 ML/d), in-stream risk quotients were all calculated to be <1.

B 2.2.3 Mackay/Whitsunday

The following tables provide in-stream risk quotients for stream flow data obtained in the use region as described in Table V2.98 in APVMA (2012). Shaded cells indicate cases where the in-stream risk quotients exceed the level of concern of 1.0.

Table B6: In-Stream Risk Quotients, Mackay/Whitsunday, December to February

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha)		
		1800	1530	1080
125002C	26	2.0	1.1	0.8
125005A	30	1.7	1.0	0.7
125006A	22	2.3	1.4	1.0
125009A	78	0.7	0.4	0.3
122004A	12	4.3	2.5	1.8
122005A	14	3.7	2.1	1.5
124001B	32	1.6	0.9	0.7
124002A	23	2.2	1.3	0.9
124003A	10	5.2	3.0	2.1
124004A	7	7.4	4.3	3.0
126001A	11	4.7	2.7	1.9
126003A	11	4.7	2.7	1.9
126007A	9	5.7	3.3	2.3

Table B7: In-Stream Risk Quotients, Mackay/Whitsunday, March to May

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha)		
		1800	1530	1080
125002C	26	1.2	0.7	0.5
125005A	30	1.0	0.6	0.4
125006A	22	1.4	0.8	0.6
125009A	78	0.4	0.2	0.2
122004A	12	2.6	1.5	1.1
122005A	14	2.2	1.3	0.9
124001B	32	1.0	0.6	0.4
124002A	23	1.4	0.8	0.5
124003A	10	3.1	1.8	1.3
124004A	7	4.5	2.5	1.8
126001A	11	2.8	1.6	1.1
126003A	11	2.8	1.6	1.1
126007A	9	3.5	2.0	1.4

For all other time periods, based on rainfall patterns and minimum flow requirements (<4.3 ML/d), in-stream risk quotients were all calculated to be <1.

B 2.2.4 Mary/Burnett

The following tables provide in-stream risk quotients for stream flow data obtained in the use region as described in Table V2.106 in APVMA (2012). Shaded cells indicate cases where the in-stream risk quotients exceed the level of concern of 1.0.

Table B8: In-Stream Risk Quotients, Mary/Burnett, December to February

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha) 1800	1530	1080
136108A	12	3.5	2.0	1.4
136111A	7	6.1	3.5	2.4
136101C	12	3.5	2.0	1.4
136006A	10	4.3	2.4	1.7
136007A	23	1.8	1.1	0.7
136011A	13	3.3	1.9	1.3
136207A	10	4.3	2.4	1.7
136118A	13	3.3	1.9	1.3
138014A	90	0.5	0.3	0.2
138903A	27	1.6	0.9	0.6
138004B	16	2.7	1.5	1.1
138003D	7	6.1	3.5	2.4
138009A	11	3.9	2.2	1.6
138012C	9	4.7	2.7	1.9
137003A	10	4.3	2.4	1.7
137101A	11	3.9	2.2	1.6
137201A	9	4.7	2.7	1.9

Table B9: In-Stream Risk Quotients, Mary/Burnett, March to May

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha) 1800	1530	1080
136108A	12	0.9	0.6	0.4
136111A	7	1.5	1.0	0.7
136101C	12	0.9	0.6	0.4
136006A	10	1.1	0.7	0.5
136007A	23	0.5	0.3	0.2
136011A	13	0.8	0.5	0.4
136207A	10	1.1	0.7	0.5
136118A	13	0.8	0.5	0.4
138014A	90	0.1	0.1	0.1
138903A	27	0.4	0.3	0.2
138004B	16	0.7	0.4	0.3
138003D	7	1.5	1.0	0.7
138009A	11	1.0	0.6	0.4
138012C	9	1.2	0.8	0.5
137003A	10	1.1	0.7	0.5
137101A	11	1.0	0.6	0.4
137201A	9	1.2	0.8	0.5

For all other time periods, based on rainfall patterns and minimum flow requirements (<4.3 ML/d), in-stream risk quotients were all calculated to be <1.

B 2.2.5 New South Wales

The following tables provide in-stream risk quotients for stream flow data obtained in the use region as described in Table V2.112 in APVMA (2012). Shaded cells indicate cases where the in-stream risk quotients exceed the level of concern of 1.0.

Table B10: In-Stream Risk Quotients, New South Wales, December to February

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha)		
		1800	1530	1080
203002	17	2.2	1.3	0.9
203005	42	0.9	0.5	0.4
203012	21	1.8	1.0	0.7
203023	15	2.5	1.4	1.0
203030	10	3.8	2.2	1.5
203034	18	2.1	1.2	0.8
203041	18	2.1	1.2	0.8
203900	45	0.8	0.5	0.3
204036	11	3.4	2.0	1.4
204037	8	4.7	2.7	1.9
204043	8	4.7	2.7	1.9
204055	12	3.1	1.8	1.3
204056	36	1.0	0.6	0.4
204067	10	3.8	2.2	1.5
204068	38	1.0	0.6	0.4
204900	191	0.2	0.1	0.1

Table B11: In-Stream Risk Quotients, New South Wales, March to May

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha)		
		1800	1530	1080
203002	17	1.5	0.9	0.6
203005	42	0.6	0.4	0.3
203012	21	1.3	0.7	0.5
203023	15	1.8	1.0	0.7
203030	10	2.6	1.5	1.1
203034	18	1.5	0.8	0.6
203041	18	1.5	0.8	0.6
203900	45	0.6	0.3	0.2
204036	11	2.4	1.4	1.0
204037	8	3.3	1.9	1.3
204043	8	3.3	1.9	1.3
204055	12	2.2	1.3	0.9
204056	36	0.7	0.4	0.3
204067	10	2.6	1.5	1.1
204068	38	0.7	0.4	0.3
204900	191	0.1	0.1	0.1

For the June to August application period, based on rainfall patterns and minimum flow requirements (<4.3 ML/d), in-stream risk quotients were all calculated to be <1.

Table B12: In-Stream Risk Quotients, New South Wales, September to November

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha) 1800	1530	1080
203002	17	0.7	0.4	0.3
203005	42	0.3	0.2	0.1
203012	21	0.6	0.3	0.2
203023	15	0.8	0.5	0.3
203030	10	1.2	0.7	0.5
203034	18	0.7	0.4	0.3
203041	18	0.7	0.4	0.3
203900	45	0.3	0.2	0.1
204036	11	1.1	0.7	0.5
204037	8	1.5	0.9	0.6
204043	8	1.5	0.9	0.6
204055	12	1.0	0.6	0.4
204056	36	0.3	0.2	0.1
204067	10	1.2	0.7	0.5
204068	38	0.3	0.2	0.1
204900	191	0.1	0.04	0.03

B 2.3 Derivation of a common rate across all regions

It is clear that at lower rainfall periods the runoff risk decreases quite significantly. If, using the time periods considered above, an application window was set from the start of June until the end of November (six month period) it would lead to significant reductions in the prediction of risk through runoff.

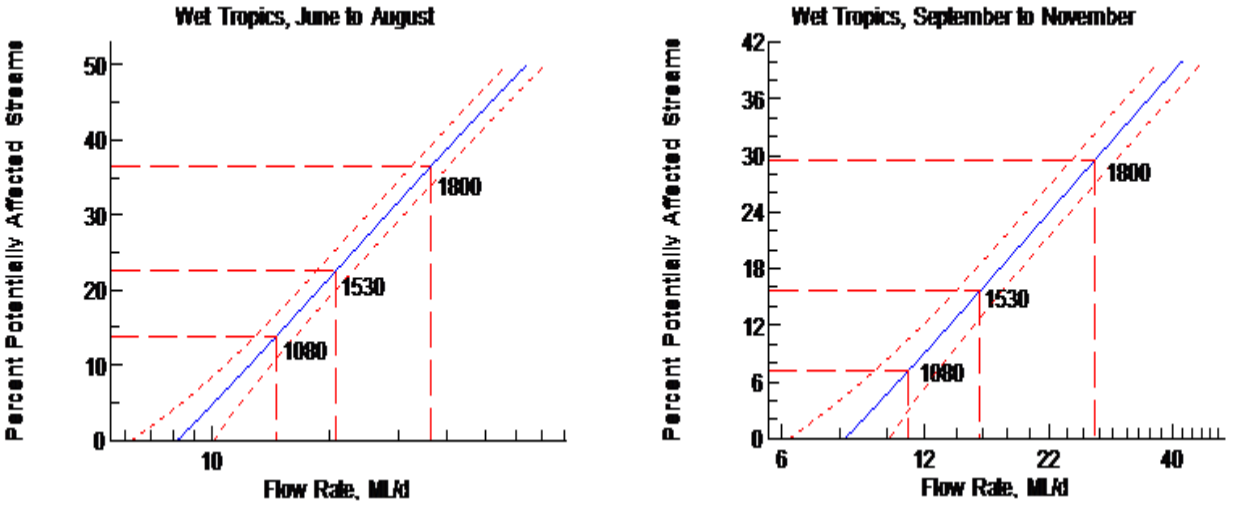
B2.3.1 Pre-emergent application

The above analysis indicates that pre-emergent use (blanket spray) at 1800 g ac/ha is difficult to support at any time in the Wet Tropics based on application to bare ground with moist soil for pre-emergent application. While it has been shown to be acceptable in the Burdekin Dry Tropics, Mackay/Whitsunday and Mary/Burnett regions, such application could only be supported in the New South Wales growing region for June-August. This makes implementation of a spray window very difficult for pre-emergence application if a common rate is desirable for all growing regions.

B 2.3.2 Post-emergent application

Still considering a six month application window of the beginning of June to the end of November, it is apparent from the in-stream calculations (3% slope remaining) that even with application to 85% of the area, this use could be supported in all regions with the exception of the Wet Tropics.

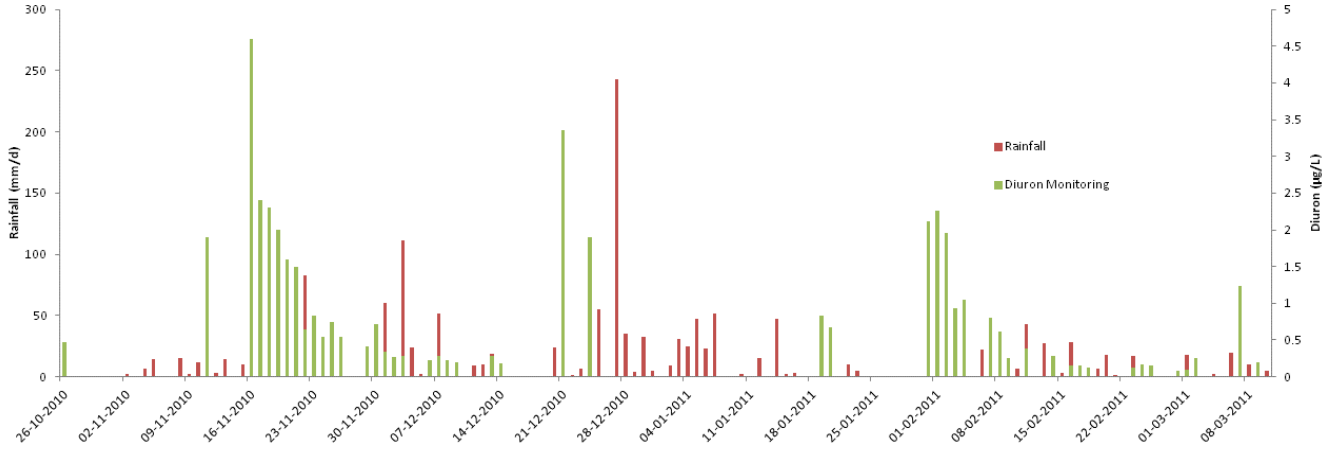
In this regard, it is useful to consider the Wet Tropics in more detail, as there were a large number (n = 26) of stream monitoring stations considered for this region. Of the 26 stations considered, in-stream risk quotients exceeded the level of concern of 1.0 on three occasions where 60% coverage was assumed, during both the June to August and September to November period. However, it needs to be recalled that not all available stream flow has been assessed for this region. If the available stream flows were distributed, the number of potentially affected streams (that is, those where in-stream risk quotients could exceed 1.0), can be estimated. The following figure shows the relationship of per cent potentially affected streams in the Wet Tropics for the June to August period and the September to November period:



This indicates that while the September to November period results in <10% streams potentially affected where coverage is at the low end of 60% of the hectare, still >10% of streams may be impacted (13.8%) in the June to August period. Such a situation makes it difficult to support post-emergence application in the Wet Tropics as rainfall in this area occurs at sufficient levels and with sufficient frequency throughout the year to continue to demonstrate an unacceptable risk.

B2.4 Monitoring data for application within the proposed window

From the most recent monitoring data available to the APVMA and described in APVMA (2012), the highest detections and longest periods of exposure were found in the Barratta and Sandy Creek sites. The data from Sandy Creek are particularly useful for this discussion as they arise from a smaller system outside the Wet Tropics, with this site being located in the Mackay/Whitsunday growing region. The following graph shows diuron monitoring outcomes (green bars) and rainfall events (red bars) over the period 26 October to 10 March 2011.



Peak diuron concentrations were found in November, which would coincide with the proposed spray window. However, it is seen that prior to this period very little rainfall was observed. While it is unclear how much additional application following the November period contributed to detections of diuron later in this sampling period, there would appear to be a good argument to end the proposed spray application window at the end of October to allow more advantage in drier periods and hence longer time frames for other environmental processes such as degradation to lower diuron loads.

B2.5 Rainfall in May and October

The analysis above has been undertaken using four three month blocks of time which coincide with summer, autumn, winter and spring. However, the spray window as proposed overlaps some of these time frames. While the above analysis broadly supports the notion that certain applications are acceptable over the period

of May through to the end of October, there is the assumption that in the March to May period, the bulk of the rainfall will occur in March compared to May, and in the September to November period, more rain will fall in November than in September or October.

This is readily checked by considering the probability of rainfall occurring in these individual months, and particularly, the rainfall value associated with P(com) = 10% for these individual months. The higher the rainfall value, the more likely a runoff event is to occur.

Rather than undertake this analysis for every weather station used in the sugar cane assessment, the March to May scenario has been assessed based on Mackay as the in-stream risk quotients above for the Mackay/Whitsunday region were highest (outside the Wet Tropics) for this period. Meanwhile, the September to November scenario has been assessed based on Grafton as the NSW region showed the highest in-stream risk quotients for this period, again, outside the Wet Tropics.

The following outcomes were found:

Table B13: P(rf) and rainfall values (mm/d) for P(com) = 10%, March to May (Mackay) and September to November (Grafton)

	March	April (Mackay)	May	September	October (Grafton)	November
P(rf)	55.4%	50.5%	38.6%	31.4%	35.2%	42.6%
Rainfall value, P(com) = 10%	21.3	15	8.9	2.8	6.2	11

This analysis increases confidence that a spray window from 1 May to 31 October will encompass the drier times of the year. In Mackay, there is a much lower chance of rainfall in May than in March or April, and the rainfall value associated with P(com) = 10% is significantly lower. Similarly, in Grafton, the chance of rainfall in November is higher than September or October, and the rainfall value associated with P(com) = 10% is much higher than the preceding two months, which along with the discussion in Section 2.4, supports the inclusion of November in the no-spray period.

B2.6 Acceptability of Co-formulations with Hexazinone

As noted in APVMA (2012, Section V2.11.5), diuron is also registered in products co-formulated with hexazinone (468 g/kg diuron and 132 g/kg hexazinone). In order to undertake an appropriate mixture toxicity assessment, DSEWPaC would need to fully assess hexazinone ecotoxicity data, which has not been done. However, it is noted that the ratio of diuron to hexazinone in the formulation is approximately 80:20.

This can be factored into in-stream risk quotients such that risk quotients of 0.8 or less as opposed to 1.0 or less are considered acceptable as a guide to determine whether the co-formulated hexazinone products are acceptable for us at the maximum rates in the spray window. The outcomes of this are presented in the summary Table 15, Conclusions below.

B3 Canegrowers proposed spray window

Canegrowers has proposed a no-use window of 1 January to 31 March. This particular period cannot be assessed in the range of months considered above in Section 2. Therefore, to assess the Canegrowers proposed window, rainfall data have been assessed on a monthly basis either side of the window in order to determine whether such a window would be acceptable.

It is clear, however, from the analysis in Section 2 that use at the rates modelled will result in an unacceptable risk in the Wet Tropics regardless of the timing of application. The following analysis is undertaken for all sugar growing regions excluding the Wet Tropics.

B3.1 Tier 2 modelling – P(com) analysis

Rainfall probability (P(rf)) values have been calculated by month for several months either side of the Canegrowers proposed no-spray window and are provided in Appendix 8 for the different applications (pre-emergent, post-emergent with 85% coverage and post-emergent with 60% coverage).

For pre-emergent use, P(com) exceeded the 10% trigger in all regions in December, and was only <10% in November and April in the Burdekin Dry Tropics. Similarly, for both 85% and 60% coverage post-emergent application, the P(com) trigger value of 10% was exceeded in all regions in December. Outside of December, the highest P(com) values were found for the Mary/Burnett and NSW sugar growing regions in November, and the Mackay/Whitsunday area in April and May. Otherwise, P(com) values were below 10%, although several values were very close to this trigger.

B3.2 Tier 3 modelling – In-Stream analysis

In line with Section 2 above, the in-stream analysis is restricted to 25th percentile stream flow rates using the rainfall value associated with a P(com) = 10%. The rainfall values and minimum flow rates calculated by monthly rainfall data for the different regions are provided in Appendix 9 and 10 respectively.

B 3.2.1 Burdekin Dry Tropics

Based on minimum flow rates of <4.3 ML/d in all months other than December, only in-stream risk quotients for December have been calculated for the Burdekin Dry Tropics. Outside December, application would result in an acceptable runoff risk, noting this relates to rainfall related runoff and does not account for irrigation which can be significant in this region.

Table B14: In-Stream Risk Quotients, Burdekin Dry Tropics, December

Station number	25th %	Effective application rate (g ac/ha)		
	Flow (ML/d)	1800	1530	1080
120110A	97	0.30	0.17	0.12
120120A	27	1.06	0.61	0.43
120216A	14	2.05	1.18	0.83
120304A	21	1.37	0.79	0.55
120305A	16	1.79	1.03	0.73
120309A	25	1.15	0.66	0.46
120106B	18	1.59	0.92	0.64
120302B	50	0.57	0.33	0.23
119003A	63	0.46	0.26	0.18
119004A	12	2.39	1.38	0.97
119006A	38	0.76	0.43	0.31
119101A	26	1.10	0.63	0.45
119102A	39	0.74	0.42	0.30
119103A	12	2.39	1.38	0.97
119104A	13	2.21	1.27	0.89

B3.2.2 Mackay/Whitsunday

Minimum flow rates of >4.3 ML/d in the Mackay/Whitsunday were found either side of the proposed spray window for pre-emergent and post-emergent (85% coverage) application in November, December, April and May. These four months have been modelled for in-stream risk quotients.

Table B15: In-Stream Risk Quotients, Mackay/Whitsunday, November

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha)		
		1800	1530	1080
125002C	26	0.35	0.23	Runoff Risk Acceptable Due to <4.3 ML/d Flow Required
125005A	30	0.31	0.20	
125006A	22	0.42	0.27	
125009A	78	0.12	0.08	
122004A	12	0.77	0.49	
122005A	14	0.66	0.42	
124001B	32	0.29	0.18	
124002A	23	0.40	0.26	
124003A	10	0.92	0.59	
124004A	7	1.31	0.84	
126001A	11	0.84	0.54	
126003A	11	0.84	0.54	
126007A	9	1.02	0.66	

Table B16: In-Stream Risk Quotients, Mackay/Whitsunday, December

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha)		
		1800	1530	1080
125002C	26	1.01	0.58	0.41
125005A	30	0.88	0.50	0.35
125006A	22	1.20	0.68	0.48
125009A	78	0.34	0.19	0.14
122004A	12	2.19	1.25	0.88
122005A	14	1.88	1.07	0.76
124001B	32	0.82	0.47	0.33
124002A	23	1.14	0.65	0.46
124003A	10	2.63	1.50	1.06
124004A	7	3.76	2.14	1.51
126001A	11	2.39	1.36	0.96
126003A	11	2.39	1.36	0.96
126007A	9	2.92	1.67	1.18

Table B17: In-Stream Risk Quotients, Mackay/Whitsunday, April

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha) 1800	1530	1080
125002C	26	1.25	0.71	0.50
125005A	30	1.08	0.62	0.44
125006A	22	1.47	0.84	0.60
125009A	78	0.42	0.24	0.17
122004A	12	2.70	1.54	1.09
122005A	14	2.31	1.32	0.94
124001B	32	1.01	0.58	0.41
124002A	23	1.41	0.80	0.57
124003A	10	3.24	1.85	1.31
124004A	7	4.63	2.64	1.87
126001A	11	2.95	1.68	1.19
126003A	11	2.95	1.68	1.19
126007A	9	3.60	2.06	1.46

Table B18: In-Stream Risk Quotients, Mackay/Whitsunday, May

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha) 1800	1530	1080
125002C	26	0.65	0.38	0.27
125005A	30	0.56	0.33	0.23
125006A	22	0.77	0.45	0.32
125009A	78	0.22	0.13	0.09
122004A	12	1.41	0.83	0.58
122005A	14	1.21	0.71	0.50
124001B	32	0.53	0.31	0.22
124002A	23	0.73	0.43	0.30
124003A	10	1.69	0.99	0.70
124004A	7	2.41	1.41	1.00
126001A	11	1.54	0.90	0.64
126003A	11	1.54	0.90	0.64
126007A	9	1.88	1.10	0.78

B3.2.3 Mary/Burnett

Minimum flow rates of >4.3 ML/d in the Mary/Burnett were found either side of the proposed spray window for pre-emergent and post-emergent (85% coverage) application in October, November, December and April. These four months have been modelled for in-stream risk quotients.

Table B19: In-Stream Risk Quotients, Mary/Burnett, October

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha) 1800	1530	1080
136108A	12	0.42		
136111A	7	0.71		
136101C	12	0.42		
136006A	10	0.50		
136007A	23	0.22		
136011A	13	0.38		
136207A	10	0.50		
136118A	13	0.38		
138014A	90	0.06		
138903A	27	0.19		
138004B	16	0.31		
138003D	7	0.71		
138009A	11	0.45		
138012C	9	0.56		
137003A	10	0.50		
137101A	11	0.45		
137201A	9	0.56		

Runoff Risk Acceptable Due to <4.3 ML/d Flow Required

Runoff Risk Acceptable Due to <4.3 ML/d Flow Required

Table B20: In-Stream Risk Quotients, Mary/Burnett, November

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha) 1800	1530	1080
136108A	12	2.21	1.28	0.90
136111A	7	3.79	2.19	1.54
136101C	12	2.21	1.28	0.90
136006A	10	2.65	1.53	1.08
136007A	23	1.15	0.67	0.47
136011A	13	2.04	1.18	0.83
136207A	10	2.65	1.53	1.08
136118A	13	2.04	1.18	0.83
138014A	90	0.29	0.17	0.12
138903A	27	0.98	0.57	0.40
138004B	16	1.66	0.96	0.68
138003D	7	3.79	2.19	1.54
138009A	11	2.41	1.39	0.98
138012C	9	2.94	1.70	1.20
137003A	10	2.65	1.53	1.08
137101A	11	2.41	1.39	0.98
137201A	9	2.94	1.70	1.20

Table B21: In-Stream Risk Quotients, Mary/Burnett, December

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha) 1800	1530	1080
136108A	12	3.10	1.77	1.86
136111A	7	5.31	3.03	3.19
136101C	12	3.10	1.77	1.86
136006A	10	3.72	2.12	2.23
136007A	23	1.62	0.92	0.97
136011A	13	2.86	1.63	1.72
136207A	10	3.72	2.12	2.23
136118A	13	2.86	1.63	1.72
138014A	90	0.41	0.24	0.25
138903A	27	1.38	0.79	0.83
138004B	16	2.33	1.33	1.39
138003D	7	5.31	3.03	3.19
138009A	11	3.38	1.93	2.03
138012C	9	4.13	2.36	2.48
137003A	10	3.72	2.12	2.23
137101A	11	3.38	1.93	2.03
137201A	9	4.13	2.36	2.48

Table B22: In-Stream Risk Quotients, Mary/Burnett, April

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha) 1800	1530	1080
136108A	12	0.88	0.57	0.40
136111A	7	1.51	0.97	0.69
136101C	12	0.88	0.57	0.40
136006A	10	1.06	0.68	0.48
136007A	23	0.46	0.30	0.21
136011A	13	0.82	0.52	0.37
136207A	10	1.06	0.68	0.48
136118A	13	0.82	0.52	0.37
138014A	90	0.12	0.08	0.05
138903A	27	0.39	0.25	0.18
138004B	16	0.66	0.43	0.30
138003D	7	1.51	0.97	0.69
138009A	11	0.96	0.62	0.44
138012C	9	1.18	0.76	0.53
137003A	10	1.06	0.68	0.48
137101A	11	0.96	0.62	0.44
137201A	9	1.18	0.76	0.53

B3.2.4 NSW sugar growing region

Minimum flow rates of >4.3 ML/d in the NSW sugar region were found either side of the proposed spray window for pre-emergent application in October, November, December, April and May. These five months have been modelled for in-stream risk quotients, although the flow requirements were only exceeded in November, December and April for post-emergent application.

Table B23: In-Stream Risk Quotients, NSW, October

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha) 1800	1530	1080
203002	17	0.30		
203005	42	0.12		
203012	21	0.24		
203023	15	0.34		
203030	10	0.51		
203034	18	0.28		
203041	18	0.28		
203900	45	0.11		
204036	11	0.46		
204037	8	0.64		
204043	8	0.64		
204055	12	0.43		
204056	36	0.14		
204067	10	0.51		
204068	38	0.13		
204900	191	0.03		

Runoff Risk Acceptable Due to <4.3 ML/d Flow Required

Runoff Risk Acceptable Due to <4.3 ML/d Flow Required

Table B24: In-Stream Risk Quotients, NSW, November

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha) 1800	1530	1080
203002	17	1.36	0.78	0.55
203005	42	0.55	0.32	0.22
203012	21	1.10	0.63	0.45
203023	15	1.55	0.89	0.63
203030	10	2.32	1.33	0.94
203034	18	1.29	0.74	0.52
203041	18	1.29	0.74	0.52
203900	45	0.52	0.30	0.21
204036	11	2.11	1.21	0.85
204037	8	2.90	1.66	1.18
204043	8	2.90	1.66	1.18
204055	12	1.93	1.11	0.78
204056	36	0.64	0.37	0.26
204067	10	2.32	1.33	0.94
204068	38	0.61	0.35	0.25
204900	191	0.12	0.07	0.05

Table B25: In-Stream Risk Quotients, NSW, December

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha) 1800	1530	1080
203002	17	1.74	0.99	0.70
203005	42	0.70	0.40	0.28
203012	21	1.40	0.80	0.57
203023	15	1.97	1.12	0.79
203030	10	2.95	1.68	1.19
203034	18	1.64	0.93	0.66
203041	18	1.64	0.93	0.66
203900	45	0.66	0.37	0.26
204036	11	2.68	1.53	1.08
204037	8	3.69	2.10	1.49
204043	8	3.69	2.10	1.49
204055	12	2.46	1.40	0.99
204056	36	0.82	0.47	0.33
204067	10	2.95	1.68	1.19
204068	38	0.78	0.44	0.31
204900	191	0.15	0.09	0.06

Table B26: In-Stream Risk Quotients, NSW, April

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha) 1800	1530	1080
203002	17	0.54	0.35	0.32
203005	42	0.22	0.14	0.13
203012	21	0.44	0.28	0.26
203023	15	0.61	0.39	0.37
203030	10	0.92	0.59	0.55
203034	18	0.51	0.33	0.31
203041	18	0.51	0.33	0.31
203900	45	0.20	0.13	0.12
204036	11	0.84	0.54	0.50
204037	8	1.15	0.74	0.69
204043	8	1.15	0.74	0.69
204055	12	0.77	0.49	0.46
204056	36	0.26	0.16	0.15
204067	10	0.92	0.59	0.55
204068	38	0.24	0.16	0.14
204900	191	0.05	0.03	0.03

Table B27: In-Stream Risk Quotients, NSW, May

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha) 1800	1530	1080
203002	17	0.30	Runoff Risk Acceptable Due to <4.3 ML/d Flow Required	Runoff Risk Acceptable Due to <4.3 ML/d Flow Required
203005	42	0.12		
203012	21	0.24		
203023	15	0.34		
203030	10	0.51		
203034	18	0.28		
203041	18	0.28		
203900	45	0.11		
204036	11	0.46		
204037	8	0.64		
204043	8	0.64		
204055	12	0.43		
204056	36	0.14		
204067	10	0.51		
204068	38	0.13		
204900	191	0.03		

B4. Statement of Uncertainties

a) The use of stream flow monitoring results is skewed to lower flow rates. There are only a small number of monitoring stations for most catchments – 13 in Mackay/Whitsunday to 17 in Mary/Burnett as time does not allow the development of the full data sets necessary for a more comprehensive probabilistic approach.

b) An apparent problem with this is the very narrow range of 25th percentile stream flow values for all growing regions except the Wet Tropics. With the exception of the Wet Tropics stream flow data, this narrow range of 25th percentile flow rates means that only small changes in rainfall values can result in quite large changes in the outcomes for in-stream risk quotients.

c) Countering the above uncertainties, modelling has been undertaken with a slope restriction of 3%. The ability for such a restraint to be complied with on pineapple farms is unclear and there remains the overall concern that the model will underestimate runoff risk from heavier soils.

d) While daily rainfall data have been analysed on a temporal scale, stream flow data are based on annual flow statistics and have not been separated by season. It is unclear what impact this may have on the outcomes above.

B5. Conclusions

The analysis undertaken for runoff risk of diuron in sugarcane where application occurs outside the wet season indicates that pre-emergence application could potentially be supported in some catchments with a spray window, but not all and the implementation of such an approach may be impractical.

B5.1 Registrant proposed no-spray window

Runoff risk from post-emergent application in the drier months is significantly lower than that previously assessed for the wet season. The results show that, while the runoff risk from post-emergent application in the Wet Tropics remains unacceptable, in all other sugar growing regions this is not the case. While the

window for application is proposed to extend from 1 May to 30 November (7 months), there is good argument to reduce this to a six month window (1 May to 31 October).

Post-emergence application at 1800 g ac/ha would be supported under this application window in the Burdekin Dry Tropics, Mackay/Whitsunday, Mary/Burnett and New South Wales sugar growing regions as the assessment indicates that even at coverage of 85%, the runoff risk is acceptable.

Table B28: Acceptability or runoff risk assessment based on application periods in sugarcane growing regions – Diuron only products

Application period	Pre-emergent, 1800 g ac/ha	Post-emergent application	
		85% cover	60% cover
Wet Tropics			
November to January	No	No	No
February to April	No	No	No
May to July	No	No	No
August to October	No	No	No
Burdekin Dry Tropics			
November to January	No	No	No
February to April	Yes	Yes	Yes
May to July	Yes	Yes	Yes
August to October	Yes	Yes	Yes
Mackay/Whitsunday			
November to January	No	No	No
February to April	No	No	No
May to July	Yes	Yes	Yes
August to October	Yes	Yes	Yes
Mary/Burnett			
November to January	No	No	No
February to April	No	Yes	Yes
May to July	Yes	Yes	Yes
August to October	Yes	Yes	Yes
New South Wales			
November to January	No	No	No
February to April	No	No	No
May to July	Yes	Yes	Yes
August to October	No	Yes	Yes

The following outcomes are summarised for diuron products co-formulated with hexazinone, as discussed in Section 2.6:

Table B29: Acceptability or runoff risk assessment based on application periods in sugarcane growing regions – Diuron/Hexazinone products

Application period	Pre-emergent, 1800 g ac/ha	Post-emergent application	
		85% cover	60% cover
Wet Tropics			
November to January	No	No	No
February to April	No	No	No
May to July	No	No	No
August to October	No	No	No
Burdekin Dry Tropics			
November to January	No	No	No
February to April	Yes	Yes	Yes
May to July	Yes	Yes	Yes
August to October	Yes	Yes	Yes
Mackay/Whitsunday			
November to January	No	No	No
February to April	No	No	No
May to July	Yes	Yes	Yes
August to October	Yes	Yes	Yes
Mary/Burnett			
November to January	No	No	No
February to April	No	No	Yes
May to July	Yes	Yes	Yes
August to October	Yes	Yes	Yes
New South Wales			
November to January	No	No	No
February to April	No	No	No
May to July	Yes	Yes	Yes
August to October	No	No	Yes

These findings remain subject to a slope restriction of 3%.

B5.2 Canegrowers proposed no-spray window

To assess the proposed three month no-spray window of 1 January to 31 March, an assessment of months either side of this no-spray period was undertaken. The following table summarises the outcomes of this assessment and indicates where runoff risk is acceptable or not.

Table B30: Acceptability or runoff risk assessment based on months of application in sugarcane growing regions – Diuron only products – Pre-emergent application, 1800 g ac/ha

Month	Burdekin Dry Tropics	Mackay/Whitsunday	Mary/Burnett	New South Wales
September	Yes	Yes	Yes	Yes
October	Yes	Yes	Yes	Yes
November	Yes	No	No	No
December	No	No	No	No
January	**NO-SPRAY WINDOW**			
February				
March				
April	Yes	No	No	No
May	Yes	No	Yes	Yes
June	Yes	Yes	Yes	Yes

Table B31: Acceptability or runoff risk assessment based on months of application in sugarcane growing regions – Diuron only products – Post-emergent application, 85% coverage (= 1530 g ac/ha)

Month	Burdekin Dry Tropics	Mackay/Whitsunday	Mary/Burnett	New South Wales
September	Yes	Yes	Yes	Yes
October	Yes	Yes	Yes	Yes
November	Yes	Yes	No	No
December	No	No	No	No
January February March	**NO-SPRAY WINDOW**			
April	Yes	No	Yes	Yes
May	Yes	No	Yes	Yes
June	Yes	Yes	Yes	Yes

Table B32: Acceptability or runoff risk assessment based on months of application in sugarcane growing regions – Diuron only products – Post-emergent application, 60% coverage (= 1080 g ac/ha)

Month	Burdekin Dry Tropics	Mackay/Whitsunday	Mary/Burnett	New South Wales
September	Yes	Yes	Yes	Yes
October	Yes	Yes	Yes	Yes
November	Yes	Yes	No	No
December	Yes	No	No	No
January February March	**NO-SPRAY WINDOW**			
April	Yes	No	Yes	Yes
May	Yes	Yes	Yes	Yes
June	Yes	Yes	Yes	Yes

These findings remain subject to a slope restriction of 3%.

The outcomes of the more detailed analysis for the Canegrowers proposed no-spray window lend support to that assessed for the registrant proposed period with the no-spray window starting at the end of October and ending at the end of April.

B6. References

APVMA, 2011. Diuron Environment Assessment. Australian Pesticides and Veterinary Medicines Authority. July 2011. www.apvma.gov.au/products/review/docs/diuron_environment.pdf

APVMA, 2012. Diuron Review Findings Report. The reconsideration of the registrations of selected products containing diuron and their associated labels. Australian Pesticides and Veterinary Medicines Authority. September 2012. www.apvma.gov.au/products/review/docs/diuron_review_report.pdf

Appendix B1 – Maximum acceptable daily rainfall (RQ<1 in Standard Water Body)

	Kd	Pre-emergent	Post-emergent	
			85%	60%
Effective rate (g ac/ha)		1800 g/ha	1530 g/ha	1080 g/ha
Wet Tropics		Maximum acceptable daily rainfall (mm/d)		
Cairns	11.8	6.6	7.7	9.3
Tully	11.8	6.6	7.7	9.3
Innisfail	11.8	6.6	7.7	9.3
Burdekin Dry Tropics				
Townsville	9.0	6.3	7.0	8.0
Ayr	9.0	6.3	7.0	8.0
Mackay/Whitsunday				
Mackay	11.8	6.6	7.7	9.3
Mary/Burnett				
Bundaberg	9.0	6.3	7.0	8.0
New South Wales				
Grafton	11.8	6.6	7.7	9.3

Appendix B2 – P(rf), P(re) and P(com) Values, December to February

	Pre-emergent	Post-Emergent	
		85%	60%
	1800 g/ha	1530 g/ha	1080 g/ha
	P(rf)	P(re)	P(re)	P(re)
Wet Tropics				
Cairns	56.7	51.7	48	44.5
Tully	51.5	68.3	65.2	61.4
Innisfail	51.6	62.4	58.1	54.6
Burdekin Dry Tropics				
Townsville	46.8	40.8	38.6	36.6
Ayr	31.9	58.5	56	53.2
Mackay/Whitsunday				
Mackay	52.1	46.6	43.3	38.6
Mary/Burnett				
Bundaberg	32.3	52.1	50.2	47.2
New South Wales				
Grafton	46.6	37.3	34.3	30.4

	P(com)	P(com)	P(com)
Wet Tropics			
Cairns	29.3	27.2	25.2
Tully	35.2	33.6	31.6
Innisfail	32.2	30.0	28.2
Burdekin Dry Tropics			
Townsville	19.1	18.1	17.1
Ayr	18.7	17.9	17.0
Mackay/Whitsunday			
Mackay	24.3	22.6	20.1
Mary/Burnett			
Bundaberg	16.8	16.2	15.2
New South Wales			
Grafton	17.4	16.0	14.2

Appendix B3 – P(rf), P(re) and P(com) Values, March to May

		Pre-emergent	Post-Emergent	
			85%	60%
		1800 g/ha	1530 g/ha	1080 g/ha
	P(rf)	P(re)	P(re)	P(re)
Wet Tropics				
Cairns	55.2	42	38.2	34
Tully	59.2	70.8	67.1	62.7
Innisfail	60.4	65.8	61.4	56.8
Burdekin Dry Tropics				
Townsville	29.1	31.7	29.9	27.5
Ayr	18.9	44.7	42.3	39.3
Mackay/Whitsunday				
Mackay	48.2	35.8	32.9	28.6
Mary/Burnett				
Bundaberg	26.1	40	38.1	34.2
New South Wales				
Grafton	46	26.2	23.1	19.4
		P(com)	P(com)	P(com)
Wet Tropics				
Cairns		23.2	21.1	18.8
Tully		41.9	39.7	37.1
Innisfail		39.7	37.1	34.3
Burdekin Dry Tropics				
Townsville		9.2	8.7	8.0
Ayr		8.4	8.0	7.4
Mackay/Whitsunday				
Mackay		17.3	15.9	13.8
Mary/Burnett				
Bundaberg		10.4	9.9	8.9
New South Wales				
Grafton		12.1	10.6	8.9

Appendix B4 – P(rf), P(re) and P(com) Values, June to August

	Pre-emergent	Post-Emergent	
		85%	60%
	1800 g/ha	1530 g/ha	1080 g/ha
	P(rf)	P(re)	P(re)	P(re)
Wet Tropics				
Cairns	28.7	17.1	13	10
Tully	36.8	52.1	48.1	43.2
Innisfail	39.1	49.5	44.5	39.5
Burdekin Dry Tropics				
Townsville	12.2	16.7	15.7	14.4
Ayr	7.8	31.8	29.6	27.2
Mackay/Whitsunday				
Mackay	27.3	20.1	17.7	14.2
Mary/Burnett				
Bundaberg	14	37.9	36.3	32.3
New South Wales				
Grafton	32.9	17.9	15.9	13.1

	P(com)	P(com)	P(com)
Wet Tropics			
Cairns	4.9	3.7	2.9
Tully	19.2	17.7	15.9
Innisfail	19.4	17.4	15.4
Burdekin Dry Tropics			
Townsville	2.0	1.9	1.8
Ayr	2.5	2.3	2.1
Mackay/Whitsunday			
Mackay	5.5	4.8	3.9
Mary/Burnett			
Bundaberg	5.3	5.1	4.5
New South Wales			
Grafton	5.9	5.2	4.3

Appendix B5 – P(rf), P(re) and P(com) Values, September to November

		Pre-emergent	Post-Emergent	
			85%	60%
		1800 g/ha	1530 g/ha	1080 g/ha
	P(rf)	P(re)	P(re)	P(re)
Wet Tropics				
Cairns	29.1	26.5	22.6	19
Tully	31.8	42.4	39.7	35.8
Innisfail	29.9	42.3	38.1	33.3
Burdekin Dry Tropics				
Townsville	17.8	10.6	8.8	6.6
Ayr	9.6	36.6	34.4	31.3
Mackay/Whitsunday				
Mackay	23	25.9	23.1	20.3
Mary/Burnett				
Bundaberg	19.8	47.5	45.3	41.5
New South Wales				
Grafton	36.4	28.2	24.87	21.2
		P(com)	P(com)	P(com)
Wet Tropics				
Cairns		7.7	6.6	5.5
Tully		13.5	12.6	11.4
Innisfail		12.6	11.4	10.0
Burdekin Dry Tropics				
Townsville		1.9	1.6	1.2
Ayr		3.5	3.3	3.0
Mackay/Whitsunday				
Mackay		6.0	5.3	4.7
Mary/Burnett				
Bundaberg		9.4	9.0	8.2
New South Wales				
Grafton		10.3	9.0	7.7

Appendix B6 – Rainfall values (mm/d) associated with P(com) = 10%

		December to February	March to May	June to August	September to November
Wet Tropics		Rainfall value (mm/d)			
Cairns	11.8	33.5	20	3.3	4.4
Tully	11.8	55.4	51.1	17	12.7
Innisfail	11.8	47.5	43.2	15	9.1
Burdekin Dry Tropics					
Townsville	9.0	22.9	5.4	<1	1
Ayr	9.0	20.8	4.3	<1	<1
Mackay/Whitsunday					
Mackay	11.8	26.9	14.4	3	2.5
Mary/Burnett					
Bundaberg	9.0	15.4	6.8	1.6	5.6
New South Wales					
Grafton	11.8	17.8	12.2	4.0	7.6

Appendix B7 – Minimum Stream Flow (ML/d) for Acceptable In-Stream Risk Quotient (RQ ≤1)

December to February

Runoff Model Scenario	1	4	4
Effective rate (g ac/ha)	1800	1530	1080
	ML/d	ML/d	ML/d
Wet Tropics			
Cairns	59.8	34.8	24.6
Tully	81.2	48.0	33.9
Innisfail	74.4	53.8	30.8
Burdekin Dry Tropics			
Townsville	58.7	33.8	23.9
Ayr	54.6	31.3	22.1
Mackay/Whitsunday			
Mackay	51.5	29.8	21.0
Mary/Burnett			
Bundaberg	42.5	24.3	17.1
New South Wales			
Grafton	37.7	21.5	15.2

March to May

Runoff Model Scenario	1	4	4
Effective rate (g ac/ha)	1800	1530	1080
	ML/d	ML/d	ML/d
Wet Tropics			
Cairns	41.4	23.7	24.8
Tully	77.6	45.8	32.3
Innisfail	70.3	41.3	29.1
Burdekin Dry Tropics			
Townsville	<4.3	<4.3	<4.3
Ayr	<4.3	<4.3	<4.3
Mackay/Whitsunday			
Mackay	31.2	17.8	12.6
Mary/Burnett			
Bundaberg	10.6	6.9	4.8
New South Wales			
Grafton	26.3	15.0	10.6

June to August

Runoff Model Scenario	1	4	4
Effective rate (g ac/ha)	1800	1530	1080
	ML/d	ML/d	ML/d
Wet Tropics			
Cairns	<4.3	<4.3	<4.3
Tully	36.2	20.7	14.6
Innisfail			
Burdekin Dry Tropics			
Townsville	<4.3	<4.3	<4.3
Ayr	<4.3	<4.3	<4.3
Mackay/Whitsunday			
Mackay	<4.3	<4.3	<4.3
Mary/Burnett			
Bundaberg	<4.3	<4.3	<4.3
New South Wales			
Grafton	<4.3	<4.3	<4.3

September to November

Runoff Model Scenario	1	4	4
Effective rate (g ac/ha)	1800	1530	1080
	ML/d	ML/d	ML/d
Wet Tropics			
Cairns	<4.3	<4.3	<4.3
Tully	27.5	15.7	11.1
Innisfail	17.5	10.2	7.2
Burdekin Dry Tropics			
Townsville	<4.3	<4.3	<4.3
Ayr	<4.3	<4.3	<4.3
Mackay/Whitsunday			
Mackay	<4.3	<4.3	<4.3
Mary/Burnett			
Bundaberg	<4.3	<4.3	<4.3
New South Wales			
Grafton	11.9	7.3	5.1

Appendix B8 –Monthly P(com) Values for Sugar Growing Regions

Month	Burdekin Dry Tropics	Mackay/ Whitsunday	Mary/Burnett	New South Wales
Pre-Emergent Application, 1800 g ac/ha				
September	1.2%	3.0%	4.8%	5.1%
October	2.1%	4.1%	9.7%	9.7%
November	7.8%	10.7%	13.6%	15.8%
December	12.8%	15.4%	14.9%	16.9%
April	7.2%	19.3%	10.3%	10.6%
May	3.8%	11.8%	7.9%	9.4%
June	2.6%	8.8%	6.2%	7.4%
Post-Emergent Application, 85% coverage, 1530 g ac/ha				
September	1.1%	2.6%	4.3%	4.6%
October	1.4%	3.8%	9.5%	8.6%
November	7.3%	9.7%	13.0%	13.8%
December	12.1%	13.4%	14.5%	15.5%
April	6.7%	17.4%	9.8%	9.2%
May	3.4%	11.0%	7.1%	8.2%
June	2.4%	7.4%	5.9%	6.8%
Post-Emergent Application, 60% coverage, 1080 g ac/ha				
September	1.0%	1.8%	4.0%	3.6%
October	0.8%	3.4%	8.5%	7.5%
November	6.7%	8.9%	12.0%	12.0%
December	11.6%	12.0%	13.8%	13.6%
April	6.1%	15.1%	8.7%	8.0%
May	3.0%	8.9%	6.4%	6.7%
June	2.3%	5.9%	5.4%	5.7%

Appendix B9 –Rainfall Values for P(com) = 10% (Monthly Analysis)

Month	Burdekin Dry Tropics	Mackay/ Whitsunday	Mary/Burnett	New South Wales
September	0.0 mm	0.8 mm	1.4 mm	2.8 mm
October	0.8 mm	1.7 mm	6.0 mm	6.2 mm
November	3.8 mm	7.0 mm	10.1 mm	11.0 mm
December	10.7 mm	12.2 mm	13.4 mm	13.6 mm
April	3.8 mm	15.0 mm	6.8 mm	7.0 mm
May	1.3 mm	8.9 mm	4.9 mm	6.2 mm
June	0.4 mm	5.5 mm	2.4 mm	4.2 mm

Appendix B10 –Minimum Flow Rates, ML/d for Acceptable In-Stream Risk Quotient (RQ ≤1 - Monthly Analysis)

Month	Burdekin Dry Tropics	Mackay/ Whitsunday	Mary/Burnett	New South Wales
Pre-Emergent Application, 1800 g ac/ha				
September	<4.3	<4.3	<4.3	<4.3
October	<4.3	<4.3	5.0	5.1
November	<4.3	9.2	26.5	23.2
December	28.7	26.3	37.2	29.5
April	<4.3	32.4	10.6	9.2
May	<4.3	16.9	<4.3	5.1
June	<4.3	<4.3	<4.3	<4.3
Post-Emergent Application, 85% coverage, 1530 g ac/ha				
September	<4.3	<4.3	<4.3	<4.3
October	<4.3	<4.3	<4.3	<4.3
November	<4.3	5.9	15.3	13.3
December	16.5	15.0	21.2	16.8
April	<4.3	18.5	6.8	5.9
May	<4.3	9.9	<4.3	<4.3
June	<4.3	<4.3	<4.3	<4.3
Post-Emergent Application, 60% coverage, 1080 g ac/ha				
September	<4.3	<4.3	<4.3	<4.3
October	<4.3	<4.3	<4.3	<4.3
November	<4.3	<4.3	10.8	9.4
December	11.6	10.6	22.3	11.9
April	<4.3	13.1	4.8	5.5
May	<4.3	7.0	<4.3	<4.3
June	<4.3	<4.3	<4.3	<4.3

Appendix C: DSEWPaC consideration of Dupont Krovar DF Herbicide (31253)

Prepared by

Australian Government

Department of Sustainability, Environment, Water, Population and Communities

Environment Protection Branch

1 November 2012

Table of Contents

1 INTRODUCTION 83
2 CITRUS 84
3 PINEAPPLES 84
4 CONCLUSIONS 94
5 REFERENCES: 96
APPENDIX 1 – MAXIMUM ACCEPTABLE DAILY RAINFALL (RQ<1 IN STANDARD WATER BODY) 97
APPENDIX 2 – P(RF), P(RE) AND P(COM) VALUES, DECEMBER TO FEBRUARY 98
APPENDIX 3 – P(RF), P(RE) AND P(COM) VALUES, MARCH TO MAY 99
APPENDIX 4 – P(RF), P(RE) AND P(COM) VALUES, JUNE TO AUGUST 100
APPENDIX 5 – P(RF), P(RE) AND P(COM) VALUES, SEPTEMBER TO NOVEMBER 101
APPENDIX 6 – RAINFALL VALUES (MM/D) ASSOCIATED WITH P(COM) = 10% 102
APPENDIX 7 – MINIMUM STREAM FLOW (ML/D) FOR ACCEPTABLE IN-STREAM RISK QUOTIENT (RQ ≤1) 103

Supplemental Environmental Assessment Report - Diuron

C1. Introduction

In September 2012 the APVMA published the Diuron Review Findings Report (APVMA, 2012). That report considered additional information provided in submissions received in response to APVMA (2011) and included the development of a runoff risk assessment framework to better address exposure through runoff for the different diuron registered uses.

APVMA (2012) concluded uses in citrus and pineapples could not be supported based on current label instructions. However, that assessment failed to consider a currently registered product, DuPont™ Krovar DF Herbicide, a product coformulated with 400 g/L diuron and 400 g/L bromacil. This product is registered for use in citrus at the same diuron rates assessed in APVMA (2012), but is registered at lower use rates in pineapples than those previously assessed.

This addendum considers the potential for runoff risks associated with the use of DuPont Krovar DF Herbicide. Additional information received from pineapple growers relating to expected timing of application has also been taken into consideration and exposure is considered in both a temporal and spatial scale at the lower registered application rates.

C2. Consideration of Bromacil

DSEWPaC has no data for bromacil presently in their data holdings as this active constituent has not been subject to an environmental risk assessment in Australia either as part of a new chemical product or through a chemical review. However, it has been the subject of a reregistration assessment by the US EPA, and this assessment provides some information on the likely effects of the bromacil component of the Krovar DF Herbicide product. The following information on bromacil fate and effects is taken from US EPA (1996).

Bromacil is a mobile and persistent herbicide. In the field, half-lives exceeded 100 days although the chemical did not demonstrate the degree of mobility that was predicted by laboratory studies and in general, was not detected below 40 cm in soil horizons based on two field dissipation studies.

Toxicity to algae/aquatic plants is only available for one algal species, *Selenastrum capricornatum* and an EC50 of 6.8 µg/L is reported. This value was used for derivation of a chronic no observed adverse effects level (NOAEL) by ENSR International in their assessment of bromacil for the United States Department of the Interior, Bureau of Land Management (ENSR International, 2005). As reported in that document, since no NOAEL value in the reviewed literature was lower than the EC50, the EC50 was divided by an uncertainty factor of 3 to estimate a NOAEL of 0.0023 mg/L (2.3 µg/L).

Bromacil has been detected in recent sampling in the Wet Tropics, albeit at very low levels (sub ng/L). During the same sampling period, no bromacil (and very little diuron) was found in the Burdekin Dry Tropics, Mackay or Fitzroy catchments during floodplume sampling (Kennedy et al, 2012).

Without undertaking a more comprehensive risk assessment of bromacil, it is not appropriate to consider such factors as mixture toxicity and the potential for combined impacts based on runoff from Krovar DF Herbicide. However, it is useful to consider potential safety margins from the modelling of diuron for the different use patterns, times and rates, because if a sufficient margin of safety is present, use of this product at certain times may still be acceptable in certain areas.

For this purpose, where risk quotients are 0.5 or less, or in the case of in-stream analysis, where the minimum flow rate is <4.3 ML/d due to the dry conditions in the different regions at the time of year being considered, then runoff risk from the combined bromacil/diuron product is considered acceptable.

C3. Citrus

Application rates for citrus are 2.2 kg product to 4.5 kg product/ha, or 880 g diuron/ha to 1800 kg diuron/ha. Label instructions are to apply to moist weed free ground in both Autumn and Spring. The diuron rates and application instructions reflect those already assessed in APVMA (2012). For diuron only products, band spraying in Autumn and Spring resulted in an effective rate of 900 g ac/ha. In the case of Krovar DF Herbicide, up to half this rate may be used due to inter-row spraying (440 g ac/ha).

However, noting the discussion on bromacil in Section 2 above, the additional influence of bromacil in this formulation needs to be considered, and the combined rate of the two active constituents would still remain at 880 g/ha for inter-row spraying, which is essentially the same as the rate considered for diuron alone in APVMA (2012). Consequently, no further refinement has been undertaken and the conclusions from APVMA (2012) with respect to citrus remain.

C4. Pineapples

Application instructions on the DuPont Krovar DF Herbicide label include both pre-emergence (blanket) sprays and direct inter-row sprays. For pre-emergent application one rate, namely 4.5 kg product/ha (1800 g diuron/ha) is registered. Instructions are to apply to moist soil prior to weed emergence after planting and before planting material begins to grow. This situation will be modelled using Scenario 1 in the runoff model.

Direct inter row sprays have two registered rates, namely full hectare rates of 2.2 kg product/ha to 4.5 kg product/ha (880 g diuron/ha to 1800 g diuron/ha). The post-emergent nature of this application means significant ground cover is expected. For this situation, Scenario 4 will be used in the runoff model.

Further with inter row spraying, not all the hectare will be treated. A range of coverage from 60% to 85% of the hectare will be modelled. The following table summarises the application rates used in the exposure modelling:

Table C1: Application Scenarios to Pineapples Based on DuPont Krovar DF Herbicide

	Pre-emergent (Scenario 1)	Post-emergent (Scenario 4)			
		4.5 kg product/ha		2.2 kg product/ha	
		85%	60%	85%	60%
Effective rate (g ac/ha)	1800 g/ha	1530 g/ha	1080 g/ha	750 g/ha	530 g/ha

Further advice has been sought from Growcom regarding the main times for use of diuron in pineapple crowing. The advice received is that the main planting windows for pineapples is March to November while the peak times are March, April and late October to early December.

While the main pineapple growing area is South East Queensland, as considered in APVMA (2012), it is also possible some pineapple growing occurs in other catchments in Queensland. In order to better understand the runoff risk associated with different times and corresponding rainfall, seasonal (December to February, March to May, June to August and September to November) assessments have been undertaken for SE Queensland, Mary/Burnett, Mackay/Whitsunday, Burdekin Dry Tropics and Wet Tropics growing regions.

C4.1 Tier 2 modelling – P(com) analysis

Modelling results for acceptable daily rainfall, rainfall probability (P(rf)), probability of exceeding the acceptable daily rainfall on wet days (P(re)), and P(com) values for all application scenarios are provided in Appendices 1 to 5. All modelling has been undertaken retaining the 3% slope restriction applied in APVMA (2012).

Not surprisingly, the highest P(com) values were associated with the wettest period (December to February) modelled. For all scenarios and in all catchments, P(com) exceeded the 10% trigger. Significantly reduced P(com) values were calculated for other (lower rainfall) periods. The 10% trigger value was continually exceeded in the Wet Tropics for all time periods modelled, although in the June to August period to lowest rate at 60% coverage was acceptable in terms of P(com) being <10% and September to November period P(com) was <10% at the lower rate for both 85% and 60% coverage assumptions.

In the Burdekin Dry Tropics, P(com) was below the 10% trigger value for all application scenarios at all time periods except the December to February wet period.

In both the Mackay/Whitsunday and Mary/Burnett growing regions, all application scenarios were acceptable in terms of P(com) for June through to the end of November. In the March to May time period, only the lowest rate at 60% coverage was acceptable in terms of P(com) in the Mackay/Whitsunday, while only the highest pre-emergent situation was unacceptable in the Mary/Burnett based on P(com).

Rainfall characteristics in SE Queensland were such that for March to May, only the lowest application rate at 60% coverage appeared acceptable based on P(com), while for the June to August period, all application scenarios were acceptable. In the September to November time period, the lowest rate was acceptable at both 85% and 60% coverage while the higher post-emergent rate was acceptable at 60% coverage based on P(com).

C4.2 Tier 3 modelling – In-Stream analysis

It was demonstrated in APVMA (2012) that at the 90th percent flow rate for an application rate of 2000 g ac/ha (“Normal Growth”, Table V2.127), no in-stream risk quotients for the streams considered exceeded a value of 1. Therefore, this analysis will be restricted to the 75th and 25th percentile flow rates.

In order to undertake the in-stream analysis, rainfall values associated with a P(com) = 10% are required as these are associated with 25th percentile stream flow rates. These values have been calculated from various weather stations in the different growing regions based on long term daily rainfall data and are provided in Appendix 6. Using these data, a minimum acceptable daily flow rate is calculated for the different growing

regions at which point the in-stream predicted concentration becomes acceptable. These minimum daily flow rates are provided in Appendix 7.

It is recognised that the streamflow monitoring data do not represent the full range of streamflows available for catchments as time did not permit such an approach. While an effort was made in selecting gauge stations to provide a large range of river and stream sizes, the selection process necessarily was targeted at smaller streams to better predict in-stream concentrations for those more likely to be at risk. This means that generally, results are skewed towards lower stream flows.

C4.2.1 Wet Tropics

The following tables provide in-stream risk quotients for stream flow data obtained in the use region as described in Table V2.80 in APVMA (2012). Shaded cells indicate cases where the in-stream risk quotients exceed the level of concern of 0.5.

Table C2: In-Stream Risk Quotients, Wet Tropics, December to February

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha)				
		1800	1530	1080	750	530
108002A	315	0.3	0.2	0.1	0.1	0.1
108007A	57	1.4	0.8	0.6	0.4	0.3
108008A	19	4.3	2.5	1.8	1.2	0.9
109001A	265	0.3	0.2	0.1	0.1	0.1
110020A	198	0.4	0.2	0.2	0.1	0.1
110011B	22	3.7	2.2	1.5	1.1	0.8
110104A	28	2.9	1.7	1.2	0.8	0.6
110018A	19	4.3	2.5	1.8	1.2	0.9
110022A	29	2.8	1.7	1.2	0.8	0.6
111005A	344	0.2	0.1	0.1	0.1	0.05
111009A	7	11.6	6.9	4.8	3.4	2.4
111010B	14	5.8	3.4	2.4	1.7	1.2
111101D	690	0.1	0.1	0.05	0.03	0.02
113004A	130	0.6	0.4	0.3	0.2	0.1
113006A	2787	0.03	0.02	0.01	0.01	0.01
113007A	34	2.4	1.4	1.0	0.7	0.5
112003A	149	0.5	0.3	0.2	0.2	0.1
112002A	24	3.4	2.0	1.4	1.0	0.7
112104A	9	9.0	5.3	3.8	2.6	1.8
112101B	704	0.1	0.1	0.05	0.03	0.02
112102A	120	0.7	0.4	0.3	0.2	0.1
116014A	25	3.2	1.9	1.4	0.9	0.7
116013A	62	1.3	0.8	0.5	0.4	0.3
116008B	54	1.5	0.9	0.6	0.4	0.3
116006B	450	0.2	0.1	0.1	0.1	0.04
116017A	10	8.1	4.8	3.4	2.4	1.7

Table C3: In-Stream Risk Quotients, Wet Tropics, March to May

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha)				
		1800	1530	1080	750	530
108002A	315	0.2	0.1	0.1	0.1	0.1
108007A	57	1.4	0.8	0.6	0.4	0.3
108008A	19	4.1	2.4	1.7	1.2	0.8
109001A	265	0.3	0.2	0.1	0.1	0.1
110020A	198	0.4	0.2	0.2	0.1	0.1
110011B	22	3.5	2.1	1.5	1.0	0.7
110104A	28	2.8	1.6	1.2	0.8	0.6
110018A	19	4.1	2.4	1.7	1.2	0.8
110022A	29	2.7	1.6	1.1	0.8	0.5
111005A	344	0.2	0.1	0.1	0.1	0.05
111009A	7	11.1	6.5	4.6	3.2	2.3
111010B	14	5.5	3.3	2.3	1.6	1.1
111101D	690	0.1	0.1	0.05	0.03	0.02
113004A	130	0.6	0.4	0.2	0.2	0.1
113006A	2787	0.03	0.02	0.01	0.01	0.01
113007A	34	2.3	1.3	1.0	0.7	0.5
112003A	149	0.5	0.3	0.2	0.2	0.1
112002A	24	3.2	1.9	1.3	0.9	0.7
112104A	9	8.6	5.1	3.6	2.5	1.8
112101B	704	0.1	0.1	0.05	0.03	0.02
112102A	120	0.6	0.4	0.3	0.2	0.1
116014A	25	3.1	1.8	1.3	0.9	0.6
116013A	62	1.3	0.7	0.5	0.4	0.3
116008B	54	1.4	0.8	0.6	0.4	0.3
116006B	450	0.2	0.1	0.1	0.1	0.04
116017A	10	7.8	4.6	3.2	2.3	1.6

Table C4: In-Stream Risk Quotients, Wet Tropics, June to August

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha)				
		1800	1530	1080	750	530
108002A	315	0.1	0.1	0.05	0.03	0.02
108007A	57	0.6	0.4	0.3	0.2	0.1
108008A	19	1.9	1.1	0.8	0.5	0.4
109001A	265	0.1	0.1	0.1	0.04	0.03
110020A	198	0.2	0.1	0.1	0.1	0.04
110011B	22	1.6	0.9	0.7	0.5	0.3
110104A	28	1.3	0.7	0.5	0.4	0.3
110018A	19	1.9	1.1	0.8	0.5	0.4
110022A	29	1.2	0.7	0.5	0.4	0.2
111005A	344	0.1	0.1	0.04	0.03	0.02
111009A	7	5.2	3.0	2.1	1.5	1.0
111010B	14	2.6	1.5	1.0	0.7	0.5
111101D	690	0.1	0.03	0.02	0.01	0.01
113004A	130	0.3	0.2	0.1	0.1	0.1
113006A	2787	0.01	0.01	0.01	0.004	0.003
113007A	34	1.1	0.6	0.4	0.3	0.2
112003A	149	0.2	0.1	0.1	0.1	0.05
112002A	24	1.5	0.9	0.6	0.4	0.3
112104A	9	4.0	2.3	1.6	1.1	0.8
112101B	704	0.1	0.03	0.02	0.01	0.01
112102A	120	0.3	0.2	0.1	0.1	0.1
116014A	25	1.4	0.8	0.6	0.4	0.3
116013A	62	0.6	0.3	0.2	0.2	0.1
116008B	54	0.7	0.4	0.3	0.2	0.1
116006B	450	0.1	0.05	0.03	0.02	0.02
116017A	10	3.6	2.1	1.5	1.0	0.7

Table C5: In-Stream Risk Quotients, Wet Tropics, September to November

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha) 1800	1530	1080	750	530
108002A	315	0.1	0.05	0.04	0.02	0.02
108007A	57	0.5	0.3	0.2	0.1	0.1
108008A	19	1.4	0.8	0.6	0.4	0.3
109001A	265	0.1	0.1	0.04	0.03	0.02
110020A	198	0.1	0.1	0.1	0.04	0.03
110011B	22	1.3	0.7	0.5	0.4	0.2
110104A	28	1.0	0.6	0.4	0.3	0.2
110018A	19	1.4	0.8	0.6	0.4	0.3
110022A	29	0.9	0.5	0.4	0.3	0.2
111005A	344	0.1	0.05	0.03	0.02	0.02
111009A	7	3.9	2.2	1.6	1.1	0.8
111010B	14	2.0	1.1	0.8	0.6	0.4
111101D	690	0.04	0.02	0.02	0.01	0.01
113004A	130	0.2	0.1	0.1	0.1	0.04
113006A	2787	0.01	0.01	0.004	0.003	0.002
113007A	34	0.8	0.5	0.3	0.2	0.2
112003A	149	0.2	0.1	0.1	0.1	0.0
112002A	24	1.1	0.7	0.5	0.3	0.2
112104A	9	3.1	1.7	1.2	0.9	0.6
112101B	704	0.04	0.02	0.02	0.01	0.01
112102A	120	0.2	0.1	0.1	0.1	0.05
116014A	25	1.1	0.6	0.4	0.3	0.2
116013A	62	0.4	0.3	0.2	0.1	0.1
116008B	54	0.5	0.3	0.2	0.1	0.1
116006B	450	0.1	0.03	0.02	0.02	0.01
116017A	10	2.8	1.6	1.1	0.8	0.5

C4.2.2 Burdekin Dry Tropics

The following tables provide in-stream risk quotients for stream flow data obtained in the use region as described in Table V2.88 in APVMA (2012). Shaded cells indicate cases where the in-stream risk quotients exceed the level of concern of 0.5.

Table C6: In-Stream Risk Quotients, Burdekin Dry Tropics, December to February

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha)				
		1800	1530	1080	750	530
120110A	97	0.6	0.3	0.2	0.2	0.1
120120A	27	2.2	1.3	0.9	0.6	0.4
120216A	14	4.2	2.4	1.7	1.2	0.8
120304A	21	2.8	1.6	1.1	0.8	0.6
120305A	16	3.7	2.1	1.5	1.0	0.7
120309A	25	2.3	1.4	1.0	0.7	0.5
120106B	18	3.3	1.9	1.3	0.9	0.7
120302B	50	1.2	0.7	0.5	0.3	0.2
119003A	63	0.9	0.5	0.4	0.3	0.2
119004A	12	4.9	2.8	2.0	1.4	1.0
119006A	38	1.5	0.9	0.6	0.4	0.3
119101A	26	2.3	1.3	0.9	0.6	0.5
119102A	39	1.5	0.9	0.6	0.4	0.3
119103A	12	4.9	2.8	2.0	1.4	1.0
119104A	13	4.5	2.6	1.8	1.3	0.9

For all other time periods, based on rainfall patterns and minimum flow requirements (<4.3 ML/d), in-stream risk quotients were all calculated to be <1.

C4.2.3 Mackay/Whitsunday

The following tables provide in-stream risk quotients for stream flow data obtained in the use region as described in Table V2.98 in APVMA (2012). Shaded cells indicate cases where the in-stream risk quotients exceed the level of concern of 0.5.

Table C7: In-Stream Risk Quotients, Mackay/Whitsunday, December to February

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha)				
		1800	1530	1080	750	530
125002C	26	2.0	1.1	0.8	0.6	0.4
125005A	30	1.7	1.0	0.7	0.5	0.3
125006A	22	2.3	1.4	1.0	0.7	0.5
125009A	78	0.7	0.4	0.3	0.2	0.1
122004A	12	4.3	2.5	1.8	1.2	0.9
122005A	14	3.7	2.1	1.5	1.0	0.7
124001B	32	1.6	0.9	0.7	0.5	0.3
124002A	23	2.2	1.3	0.9	0.6	0.4
124003A	10	5.2	3.0	2.1	1.5	1.0
124004A	7	7.4	4.3	3.0	2.1	1.5
126001A	11	4.7	2.7	1.9	1.3	0.9
126003A	11	4.7	2.7	1.9	1.3	0.9
126007A	9	5.7	3.3	2.3	1.6	1.1

Table C8: In-Stream Risk Quotients, Mackay/Whitsunday, March to May

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha)				
		1800	1530	1080	750	530
125002C	26	1.2	0.7	0.5	0.3	0.2
125005A	30	1.0	0.6	0.4	0.3	0.2
125006A	22	1.4	0.8	0.6	0.4	0.3
125009A	78	0.4	0.2	0.2	0.1	0.1
122004A	12	2.6	1.5	1.1	0.7	0.5
122005A	14	2.2	1.3	0.9	0.6	0.4
124001B	32	1.0	0.6	0.4	0.3	0.2
124002A	23	1.4	0.8	0.5	0.4	0.3
124003A	10	3.1	1.8	1.3	0.9	0.6
124004A	7	4.5	2.5	1.8	1.2	0.9
126001A	11	2.8	1.6	1.1	0.8	0.6
126003A	11	2.8	1.6	1.1	0.8	0.6
126007A	9	3.5	2.0	1.4	1.0	0.7

For all other time periods, based on rainfall patterns and minimum flow requirements (<4.3 ML/d), in-stream risk quotients were all calculated to be <0.5.

C4.2.4 Mary/Burnett

The following tables provide in-stream risk quotients for stream flow data obtained in the use region as described in Table V2.106 in APVMA (2012). Shaded cells indicate cases where the in-stream risk quotients exceed the level of concern of 0.5.

Table C9: In-Stream Risk Quotients, Mary/Burnett, December to February

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha)				
		1800	1530	1080	750	530
136108A	12	3.5	2.0	1.4	1.0	0.7
136111A	7	6.1	3.5	2.4	1.7	1.2
136101C	12	3.5	2.0	1.4	1.0	0.7
136006A	10	4.3	2.4	1.7	1.2	0.8
136007A	23	1.8	1.1	0.7	0.5	0.4
136011A	13	3.3	1.9	1.3	0.9	0.6
136207A	10	4.3	2.4	1.7	1.2	0.8
136118A	13	3.3	1.9	1.3	0.9	0.6
138014A	90	0.5	0.3	0.2	0.1	0.1
138903A	27	1.6	0.9	0.6	0.4	0.3
138004B	16	2.7	1.5	1.1	0.7	0.5
138003D	7	6.1	3.5	2.4	1.7	1.2
138009A	11	3.9	2.2	1.6	1.1	0.8
138012C	9	4.7	2.7	1.9	1.3	0.9
137003A	10	4.3	2.4	1.7	1.2	0.8
137101A	11	3.9	2.2	1.6	1.1	0.8
137201A	9	4.7	2.7	1.9	1.3	0.9

Table C10: In-Stream Risk Quotients, Mary/Burnett, March to May

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha)				
		1800	1530	1080	750	530
136108A	12	0.9	0.6	0.4	<0.4	<0.4
136111A	7	1.5	1.0	0.7	<0.6	<0.6
136101C	12	0.9	0.6	0.4	<0.4	<0.4
136006A	10	1.1	0.7	0.5	<0.4	<0.4
136007A	23	0.5	0.3	0.2	<0.2	<0.2
136011A	13	0.8	0.5	0.4	<0.3	<0.3
136207A	10	1.1	0.7	0.5	<0.4	<0.4
136118A	13	0.8	0.5	0.4	<0.3	<0.3
138014A	90	0.1	0.1	0.1	<0.0	<0.0
138903A	27	0.4	0.3	0.2	<0.2	<0.2
138004B	16	0.7	0.4	0.3	<0.3	<0.3
138003D	7	1.5	1.0	0.7	<0.6	<0.6
138009A	11	1.0	0.6	0.4	<0.4	<0.4
138012C	9	1.2	0.8	0.5	<0.5	<0.5
137003A	10	1.1	0.7	0.5	<0.4	<0.4
137101A	11	1.0	0.6	0.4	<0.4	<0.4
137201A	9	1.2	0.8	0.5	<0.5	<0.5

For all other time periods, based on rainfall patterns and minimum flow requirements (<4.3 ML/d), in-stream risk quotients were all calculated to be <0.5.

C4.2.5 SE Queensland

The following tables provide in-stream risk quotients for stream flow data obtained in the use region as described in Table V2.122 in APVMA (2012). Shaded cells indicate cases where the in-stream risk quotients exceed the level of concern of 0.5.

Table C11: In-Stream Risk Quotients, South East Queensland, December to February

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha)				
		1800	1530	1080	750	530
141001B	12	4.0	2.3	1.6	1.1	0.8
141003C	11	4.4	2.5	1.8	1.2	0.9
141004B	13	3.7	2.1	1.5	1.0	0.7
141006A	10	4.8	2.8	2.0	1.4	1.0
141008A	13	3.7	2.1	1.5	1.0	0.7
141009A	9	5.4	3.1	2.2	1.5	1.1
141010A	16	3.0	1.7	1.2	0.8	0.6

Table C12: In-Stream Risk Quotients, South East Queensland, March to May

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha)				
		1800	1530	1080	750	530
141001B	12	2.8	1.6	1.1	0.8	0.6
141003C	11	3.1	1.7	1.2	0.9	0.6
141004B	13	2.6	1.5	1.0	0.7	0.5
141006A	10	3.4	1.9	1.4	0.9	0.7
141008A	13	2.6	1.5	1.0	0.7	0.5
141009A	9	3.7	2.1	1.5	1.0	0.7
141010A	16	2.1	1.2	0.9	0.6	0.4

Table C13: In-Stream Risk Quotients, South East Queensland, June to August

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha)				
		1800	1530	1080	750	530
141001B	12	<0.4	<0.4	<0.4	<0.4	<0.4
141003C	11	<0.4	<0.4	<0.4	<0.4	<0.4
141004B	13	<0.3	<0.3	<0.3	<0.3	<0.3
141006A	10	<0.4	<0.4	<0.4	<0.4	<0.4
141008A	13	<0.3	<0.3	<0.3	<0.3	<0.3
141009A	9	<0.5	<0.5	<0.5	<0.5	<0.5
141010A	16	<0.3	<0.3	<0.3	<0.3	<0.3

Table C14: In-Stream Risk Quotients, South East Queensland, September to November

Station number	25th % Flow (ML/d)	Effective application rate (g ac/ha)				
		1800	1530	1080	750	530
141001B	12	1.3	0.8	0.6	0.4	<0.4
141003C	11	1.4	0.8	0.6	0.4	<0.4
141004B	13	1.2	0.7	0.5	0.4	<0.3
141006A	10	1.5	0.9	0.7	0.5	<0.4
141008A	13	1.2	0.7	0.5	0.4	<0.3
141009A	9	1.7	1.0	0.7	0.5	<0.5
141010A	16	1.0	0.6	0.4	0.3	<0.3

C4.3 Statement of Uncertainties

e) The use of stream flow monitoring results is skewed to lower flow rates. There are only a small number of monitoring stations for most catchments – 7 in SE QLD to 17 in Mary/Burnett as time does not allow the development of the full data sets necessary for a more comprehensive probabilistic approach.

f) An apparent problem with this is the very narrow range of 25th percentile stream flow values for all growing regions except the Wet Tropics. With the exception of the Wet Tropics stream flow data, this narrow range of 25th percentile flow rates means that only small changes in rainfall values can result in quite large changes in the outcomes for in-stream risk quotients.

g) Countering the above uncertainties, modelling has been undertaken with a slope restriction of 3%. The ability for such a restraint to be complied with on pineapple farms is unclear and there remains the overall concern that the model will underestimate runoff risk from heavier soils.

h) While daily rainfall data have been analysed on a temporal scale, stream flow data are based on annual flow statistics and have not been separated by season. It is unclear what impact this may have on the outcomes above.

C5. Conclusions

The DuPont™ Krovar DF Herbicide product has diuron rates registered for use in pineapples lower than those previously considered, and include label instructions for inter-row application. This product is co-formulated with bromacil, which is a persistent, mobile and toxic herbicide.

The use rates have been considered in both a time scale (considering application within different times of the year) and a spatial scale (considering different regions where pineapples may be grown) to determine whether the reduced rates on this product label can be supported. The confounding factor of bromacil has been considered through increasing margins of safety (that is, accepting risk quotients of 0.5 or less as opposed to the standard 1.0 or less). The following table summarises the findings:

Table C15: Acceptability of runoff risk assessment based on application period for DuPont Krovar Herbicide in Pineapples

Application period	Pre-emergent, 4.5 kg prod/ha	Post-emergent, 4.5 kg prod/ha		Post-emergent, 2.2 kg prod/ha	
		85% cover	60% cover	85% cover	60% cover
Wet Tropics					
December to Feb	No	No	No	No	No
March to May	No	No	No	No	No
June to August	No	No	No	No	No
Sept to Nov	No	No	No	No	No
Burdekin Dry Tropics					
December to Feb	No	No	No	No	No
March to May	Yes	Yes	Yes	Yes	Yes
June to August	Yes	Yes	Yes	Yes	Yes
Sept to Nov	Yes	Yes	Yes	Yes	Yes
Mackay/Whitsunday					
December to Feb	No	No	No	No	No
March to May	No	No	No	No	No
June to August	Yes	Yes	Yes	Yes	Yes
Sept to Nov	Yes	Yes	Yes	Yes	Yes
Mary/Burnett					
December to Feb	No	No	No	No	No
March to May	No	No	No	Yes	Yes
June to August	Yes	Yes	Yes	Yes	Yes
Sept to Nov	Yes	Yes	Yes	Yes	Yes
South East Queensland					
December to Feb	No	No	No	No	No
March to May	No	No	No	No	No
June to August	Yes	Yes	Yes	Yes	Yes
Sept to Nov	No	No	No	Yes	Yes

As can be seen this summary indicates a range of acceptable risk in different times of the year, ranging from March to November at all rates for the Burdekin Dry Tropics, to unacceptable risk for all months and rates in the Wet tropics.

These findings also remain subject to a slope restriction of 3% or less. It is unclear how practicable this is for pineapple growing.

C6. References

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Appendix C1 – Maximum acceptable daily rainfall (RQ<1 in Standard Water Body)

	Kd	Pre-emergent	Post-emergent			
			4.5 kg product/ha		2.2 kg product/ha	
			85%	60%	85%	60%
Effective rate (g ac/ha)		1800 g/ha	1530 g/ha	1080 g/ha	750 g/ha	530 g/ha
Wet Tropics		Maximum acceptable daily rainfall (mm/d)				
Cairns	11.8	6.6	7.7	9.3	13.5	24.0
Tully	11.8	6.6	7.7	9.3	13.5	24.0
Innisfail	11.8	6.6	7.7	9.3	13.5	24.0
Burdekin Dry Tropics						
Townsville	9.0	6.3	7.0	8.0	10.5	14.8
Ayr	9.0	6.3	7.0	8.0	10.5	14.8
Mackay/Whitsunday						
Mackay	11.8	6.6	7.7	9.3	13.5	24.0
Mary/Burnett						
Bundaberg	9.0	6.3	7.0	8.0	10.5	14.8
South East Queensland						
Beerburrum	9.0	6.3	7.0	8.0	10.5	14.8

Appendix C2 – P(rf), P(re) and P(com) Values, December to February

		Pre-	Post-Emergent			
		4.5 kg	4.5 kg prod/ha		2.2 kg prod/ha	
		prod/ha	85%	60%	85%	60%
	P(rf)	P(re)	P(re)	P(re)	P(re)	P(re)
Wet Tropics						
Cairns	56.7	51.7	48	44.5	36.5	24.5
Tully	51.5	68.3	65.2	61.4	52.6	38.5
Innisfail	51.6	62.4	58.1	54.6	45.7	33.6
Burdekin Dry Tropics						
Townsville	46.8	40.8	38.6	36.6	31.9	25.1
Ayr	31.9	58.5	56	53.2	47.2	39.9
Mackay/Whitsunday						
Mackay	52.1	46.6	43.3	38.6	31.4	20.9
Mary/Burnett						
Bundaberg	32.3	52.1	50.2	47.2	41	32.1
South East Queensland						
Beerburrum	46.3	44.2	41.9	38.7	32.6	25.3

		P(com)	P(com)	P(com)	P(com)	P(com)
Wet Tropics						
Cairns		29.3	27.2	25.2	20.7	13.9
Tully		35.2	33.6	31.6	27.1	19.8
Innisfail		32.2	30.0	28.2	23.6	17.3
Burdekin Dry Tropics						
Townsville		19.1	18.1	17.1	14.9	11.7
Ayr		18.7	17.9	17.0	15.1	12.7
Mackay/Whitsunday						
Mackay		24.3	22.6	20.1	16.4	10.9
Mary/Burnett						
Bundaberg		16.8	16.2	15.2	13.2	10.4
South East Queensland						
Beerburrum		20.5	19.4	17.9	15.1	11.7

Appendix C3 – P(rf), P(re) and P(com) Values, March to May

		Pre-	Post-Emergent			
		4.5 kg	4.5 kg prod/ha		2.2 kg prod/ha	
		prod/ha	85%	60%	85%	60%
	P(rf)	P(re)	P(re)	P(re)	P(re)	P(re)
Wet Tropics						
Cairns	55.2	42	38.2	34	25.3	15.5
Tully	59.2	70.8	67.1	62.7	53	37
Innisfail	60.4	65.8	61.4	56.8	46.6	30.1
Burdekin Dry Tropics						
Townsville	29.1	31.7	29.9	27.5	23.1	17.8
Ayr	18.9	44.7	42.3	39.3	33.8	27.2
Mackay/Whitsunday						
Mackay	48.2	35.8	32.9	28.6	21.9	12.6
Mary/Burnett						
Bundaberg	26.1	40	38.1	34.2	27.4	19.9
South East Queensland						
Beerburrum	42.1	37.1	35.5	32.6	26.8	20.5
		P(com)	P(com)	P(com)	P(com)	P(com)
Wet Tropics						
Cairns		23.2	21.1	18.8	14.0	8.6
Tully		41.9	39.7	37.1	31.4	21.9
Innisfail		39.7	37.1	34.3	28.1	18.2
Burdekin Dry Tropics						
Townsville		9.2	8.7	8.0	6.7	5.2
Ayr		8.4	8.0	7.4	6.4	5.1
Mackay/Whitsunday						
Mackay		17.3	15.9	13.8	10.6	6.1
Mary/Burnett						
Bundaberg		10.4	9.9	8.9	7.2	5.2
South East Queensland						
Beerburrum		15.6	14.9	13.7	11.3	8.6

Appendix C4 – P(rf), P(re) and P(com) Values, June to August

		Pre-	Post-Emergent			
		4.5 kg	4.5 kg prod/ha		2.2 kg prod/ha	
		prod/ha	85%	60%	85%	60%
	P(rf)	P(re)	P(re)	P(re)	P(re)	P(re)
Wet Tropics						
Cairns	28.7	17.1	13	10	5.3	1.9
Tully	36.8	52.1	48.1	43.2	33	18.2
Innisfail	39.1	49.5	44.5	39.5	28.7	14.1
Burdekin Dry Tropics						
Townsville	12.2	16.7	15.7	14.4	11.4	8.6
Ayr	7.8	31.8	29.6	27.2	21.7	15.9
Mackay/Whitsunday						
Mackay	27.3	20.1	17.7	14.2	10	5.3
Mary/Burnett						
Bundaberg	14	37.9	36.3	32.3	24.2	19.1
South East Queensland						
Beerburrum	24.4	30.9	28.7	25.9	21.6	16.6
		P(com)	P(com)	P(com)	P(com)	P(com)
Wet Tropics						
Cairns		4.9	3.7	2.9	1.5	0.5
Tully		19.2	17.7	15.9	12.1	6.7
Innisfail		19.4	17.4	15.4	11.2	5.5
Burdekin Dry Tropics						
Townsville		2.0	1.9	1.8	1.4	1.0
Ayr		2.5	2.3	2.1	1.7	1.2
Mackay/Whitsunday						
Mackay		5.5	4.8	3.9	2.7	1.4
Mary/Burnett						
Bundaberg		5.3	5.1	4.5	3.4	2.7
South East Queensland						
Beerburrum		7.5	7.0	6.3	5.3	4.1

Appendix C5 – P(rf), P(re) and P(com) Values, September to November

		Pre-	Post-Emergent			
		4.5 kg	4.5 kg prod/ha		2.2 kg prod/ha	
		prod/ha	85%	60%	85%	60%
	P(rf)	P(re)	P(re)	P(re)	P(re)	P(re)
Wet Tropics						
Cairns	29.1	26.5	22.6	19	12.2	5.6
Tully	31.8	42.4	39.7	35.8	26.7	13.4
Innisfail	29.9	42.3	38.1	33.3	24.7	13.7
Burdekin Dry Tropics						
Townsville	17.8	10.6	8.8	6.6	2.7	0.5
Ayr	9.6	36.6	34.4	31.3	25.3	19.8
Mackay/Whitsunday						
Mackay	23	25.9	23.1	20.3	15.6	8.3
Mary/Burnett						
Bundaberg	19.8	47.5	45.3	41.5	33.7	25.9
South East Queensland						
Beerburrum	30.6	37.8	35.3	31.8	25.8	19.4
		P(com)	P(com)	P(com)	P(com)	P(com)
Wet Tropics						
Cairns		7.7	6.6	5.5	3.6	1.6
Tully		13.5	12.6	11.4	8.5	4.3
Innisfail		12.6	11.4	10.0	7.4	4.1
Burdekin Dry Tropics						
Townsville		1.9	1.6	1.2	0.5	0.1
Ayr		3.5	3.3	3.0	2.4	1.9
Mackay/Whitsunday						
Mackay		6.0	5.3	4.7	3.6	1.9
Mary/Burnett						
Bundaberg		9.4	9.0	8.2	6.7	5.1
South East Queensland						
Beerburrum		11.6	10.8	9.7	7.9	5.9

Appendix C6 – Rainfall values (mm/d) associated with P(com) = 10%

		December to February	March to May	June to August	September to November
Wet Tropics		Rainfall value (mm/d)			
Cairns	11.8	33.5	20	3.3	4.4
Tully	11.8	55.4	51.1	17	12.7
Innisfail	11.8	47.5	43.2	15	9.1
Burdekin Dry Tropics					
Townsville	9.0	22.9	5.4	<1	1
Ayr	9.0	20.8	4.3	<1	<1
Mackay/Whitsunday					
Mackay	11.8	26.9	14.4	3	2.5
Mary/Burnett					
Bundaberg	9.0	15.4	6.8	1.6	5.6
South East Queensland					
Beerburrum	9.0	17.8	12.2	4	7.6

Appendix C7 – Minimum Stream Flow (ML/d) for Acceptable In-Stream Risk Quotient (RQ ≤1)

December to February

Runoff Model Scenario	1	4	4	4	4
Effective rate (g ac/ha)	1800	1530	1080	750	530
	ML/d	ML/d	ML/d	ML/d	ML/d
Wet Tropics					
Cairns	59.8	34.8	24.6	17.1	12.1
Tully	81.2	48.0	33.9	23.5	16.6
Innisfail	74.4	53.8	30.8	21.5	15.2
Burdekin Dry Tropics					
Townsville	58.7	33.8	23.9	16.6	11.7
Ayr	54.6	31.3	22.1	15.4	10.9
Mackay/Whitsunday					
Mackay	51.5	29.8	21.0	14.6	10.3
Mary/Burnett					
Bundaberg	42.5	24.3	17.1	11.9	8.4
South East Queensland					
Beerburrum	48.2	27.6	19.5	13.5	9.6

March to May

Runoff Model Scenario	1	4	4	4	4
Effective rate (g ac/ha)	1800	1530	1080	750	530
	ML/d	ML/d	ML/d	ML/d	ML/d
Wet Tropics					
Cairns	41.4	23.7	24.8	11.6	8.2
Tully	77.6	45.8	32.3	22.5	15.9
Innisfail	70.3	41.3	29.1	20.2	14.3
Burdekin Dry Tropics					
Townsville	<4.3	<4.3	<4.3	<4.3	<4.3
Ayr	<4.3	<4.3	<4.3	<4.3	<4.3
Mackay/Whitsunday					
Mackay	31.2	17.8	12.6	8.7	6.2
Mary/Burnett					
Bundaberg	10.6	6.9	4.8	<4.3	<4.3
South East Queensland					
Beerburrum	33.6	19.2	13.6	9.4	6.7

June to August

Runoff Model Scenario	1	4	4	4	4
Effective rate (g ac/ha)	1800	1530	1080	750	530
	ML/d	ML/d	ML/d	ML/d	ML/d
Wet Tropics					
Cairns	<4.3	<4.3	<4.3	<4.3	<4.3
Tully	36.2	20.7	14.6	10.2	7.2
Innisfail					
Burdekin Dry Tropics					
Townsville	<4.3	<4.3	<4.3	<4.3	<4.3
Ayr	<4.3	<4.3	<4.3	<4.3	<4.3
Mackay/Whitsunday					
Mackay	<4.3	<4.3	<4.3	<4.3	<4.3
Mary/Burnett					
Bundaberg	<4.3	<4.3	<4.3	<4.3	<4.3
South East Queensland					
Beerburrum	<4.3	<4.3	<4.3	<4.3	<4.3

September to November

Runoff Model Scenario	1	4	4	4	4
Effective rate (g ac/ha)	1800	1530	1080	750	530
	ML/d	ML/d	ML/d	ML/d	ML/d
Wet Tropics					
Cairns	<4.3	<4.3	<4.3	<4.3	<4.3
Tully	27.5	15.7	11.1	7.7	5.4
Innisfail	17.5	10.2	7.2	5.0	<4.3
Burdekin Dry Tropics					
Townsville	<4.3	<4.3	<4.3	<4.3	<4.3
Ayr	<4.3	<4.3	<4.3	<4.3	<4.3
Mackay/Whitsunday					
Mackay	<4.3	<4.3	<4.3	<4.3	<4.3
Mary/Burnett					
Bundaberg	<4.3	<4.3	<4.3	<4.3	<4.3
South East Queensland					
Beerburrum	15.3	9.3	6.6	4.6	<4.3