CANEGROWERS

SUBMISSION

Diuron and its use by sugarcane growers in the Queensland Sugar Industry

Submission to the APVMA

September 2011

About CANEGROWERS

CANEGROWERS is the peak representative body for Australian sugarcane growers. Around 80% of Queensland sugarcane growers are members of the highly successful lobby, representation and services group. Based in Queensland, the State that produces around 95% of Australia's raw sugar output, CANEGROWERS Queensland represents the interests of cane growers Australia wide.

Government and business leaders recognise CANEGROWERS as the authoritative voice of cane growers. Membership ensures that growers' needs are represented at the highest possible levels of industry and government decision-making. We safeguard growers' interests on all issues likely to affect their business.

The CANEGROWERS organisation exists to:

- Provide strong leadership for cane growers within a viable sugar industry
- Deliver effective representation and valuable services to Queensland cane growers
- Ensure cane grower strength and influence at local, district and state/national/international levels through unity and shared common values.

Sugar is one of Australia's most important rural industries, worth around $1.5 - $2.5 billion to the Australian economy. Since 1970, world sugar production has undergone massive changes. As the global demand for sugar increases, so does the environmental scrutiny of agriculture, particularly in developed countries. CANEGROWERS regard sustainability not as a cost but as a potential means of further improving our productivity and efficiency. Most importantly, we see sustainability as a basis for ensuring long term viability and the guarantee that future generations will continue to produce sugar - at a profit.

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Executive summary

CANEGROWERS is extremely concerned about the latest review of the chemical diuron and the potential loss of effective rates for weed management in the sugarcane production system. Diuron is an important residual herbicide for weed management in the Queensland sugarcane industry.

CANEGROWERS has reviewed the *Environmental Assessment on Diuron July 2011* and has been working with the University of Sydney, Nufarm and Farmoz on a detailed technical response. CANEGROWERS has also been working with industry groups to provide further information on diuron.

CANEGROWERS is concerned that the rates of application provided for primary and secondary streams are overprotective and unworkable in terms of efficacy of product at reduced rates. CANEGROWERS also considered the modelling behind these figures did not represent the characteristics of a sugarcane farming system.

CANEGROWERS support the analysis conducted by the University of Sydney in its conclusion that the APVMA's assessments are excessively protective in their approach, being based on assumptions that are unjustified or inconsistent. For further detail we refer to the report "Independent review of APVMA's Diuron review report for immediate action volumes 1 and 2 the reconsideration of the active constituent diuron, the registration of products containing diuron and approvals of associated labels"

For modelling on primary streams CANEGROWERS question:

- The appropriateness of agricultural drains being surrogates for primary streams
- The runoff characteristics from citrus orchards being representative of annual cropping such as sugarcane farming
- The difference between application rates of sugarcane and citrus orchards

For risk related to birds, CANEGROWERS question:

- Which bird species could acquire significant levels of diuron from a sugarcane field given the effect of herbicides on weeds and management practices within the industry?
- The relevance of the findings to species occurring in sugarcane fields

In order to provide information for this submission, CANEGROWERS developed a questionnaire on diuron usage within the sugarcane industry to verify usage rates of growers and to better understand the circumstances behind the application of products containing diuron. The resulting data supported the conclusions in this report, showing that most users of diuron applied it at rates less than 1.8kg ac/ha.

CANEGROWERS also highlights a range of mitigation measures and provides an overview of the Reef Rescue and Reef Regulation programs as well as R&D projects that are currently underway. The sugarcane industry is engaged in these programs and these will have a significant bearing on the impact of diuron on the environment

Recommendations and conclusions

1. CANEGROWERS supports the work undertaken by the University of Sydney and the counter-argument it brings to the risk diuron poses to the environment. CANEGROWERS recommends that APVMA fully consider this work in determining new levels of unacceptable risk to primary streams, birds and secondary streams.

2. CANEGROWERS supports the continued use of diuron at a rate of 1.8kg active constituent per hectare per year.

3. CANEGROWERS concludes that diuron products are used by more than 80% of the industry. This demonstrates the importance of the product to the sugarcane industry.

4. CANEGROWERS concludes that on average growers apply diuron once on plant cane and once on ratoon cane.

5. CANEGROWERS concludes that diuron is generally used at rates of 1.8kg ac/ha, which is half the current label rate. This indicates that it is efficacious at these rates.

6. CANEGROWERS concludes that diuron is an important product to manage the broad weed spectrum in the sugarcane industry

7. CANEGROWERS concludes that diuron is mainly used as a mixture with other herbicide products. This demonstrated the importance of the product to the sugarcane industry.

8. CANEGROWERS concludes that diuron is an effective product in controlling weeds and its loss would lead to greater weed pressure, more herbicide substitution and greater use of products such as paraquat.

9. CANEGROWERS concludes that diuron is applied with several different spray rigs and nozzle configurations. The use of Irvin legs and air inducted nozzles is favoured but other application methods should continue to be available.

10. CANEGROWERS concludes that the loss of diuron would place a significant cost burden on growers. This could lead to alternative weed management systems such as cultivation which could lead to perverse water quality outcomes.

11. CANEGROWERS concludes that the majority of growers have undertaken chemical training over the last five years. Sugarcane growers have been voluntarily undertaking chemical training for growers since this training was first introduced with support from CANEGROWERS.

12. CANEGROWERS concludes that industry practices, products and systems have considerable reduced the potential risk to the environment from diuron. CANEGROWERS believe the industry is continually improving through R,D&E and these changes need to be acknowledged and assessed in the review of diuron.

13. CANEGROWERS notes that the use of diuron is an essential part of the green cane trash blanket harvesting systems which provides benefits including:
    - Dramatic reduction in soil erosion and run-off
    - Recycling of nutrients
    - Improved soil structure and moisture holding capacity
    - Reduced weed infestation

    As essential part of this farming system is the ability to control weeds that do emerge chemically, rather than mechanically. There are significant concerns if diuron is no longer available, farmers would revert to mechanical cultivation which would see increases in soil loss and run-off and declines in water quality.

14. CANEGROWERS recommends that $200 million Reef Rescue program that sits under the Reef Plan is evaluated in the APVMA's review of diuron. Both have targets to improve water quality and reduce herbicides by 25% and 50% respectively. Herbicides of interest under both programs include diuron.

15. CANEGROWERS recommends that the Queensland State Government's Reef Regulations that targeted residual PSII herbicides, particularly diuron, is evaluated in the APVMA's review of diuron.

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Acknowledgements

CANEGROWERS gratefully acknowledges CANEGROWERS Queensland and CANEGROWERS District Managers and staff for their support and assistance with information of diuron and compiling the questionnaire.

CANEGROWERS gratefully acknowledge staff from BSES including Dr Peter Allsopp, Greg Shannon and Trevor Wilcox for their advice and data on diuron.

Introduction

CANEGROWERS are extremely concerned about the latest review of the chemical diuron and the potential loss of effective rates for weed management in the sugarcane production system.

We were advised through the APVMA that the continued use of the chemical diuron in many situations may present unacceptable risks to the environment. The APVMA have requested the manufacturers of diuron to 'show cause' as to why the product shouldn't be suspended and have also offered industry groups and opportunity to respond.

CANEGROWERS are advocating the continued use of diuron at 1.8kg active constituent per hectare per year.

Diuron is an important residual herbicide for weed management in the Queensland sugar cane industry. Diuron and products containing diuron, including Velpar K4 (diuron-hexazinone) as well as tank mixes using diuron, gramoxone and 2,4-D are used judiciously to manage grasses, broadleaf weed and vines across the industry in conjunction with sugarcane best management practices.

Within the cane industry and the circumstances under which it operates, if diuron is removed it leaves a serious gap that cannot be readily filled with alternative products. Hexazinone is effective only in mixtures with diuron; ametryn is used mainly with atrazine which cannot be used within 20m of any watercourse as per its label condition. The newer "softer" products including Soccer, Balance and Flame all have limitations, with Flame unable to be used within 50m of a watercourse according to label conditions. A reliance on knockdowns is not practical, given the wet season, timing of application, access to paddocks and the strong possibility of weed resistance.

There is a strong economic and social aspect linked to this potential loss of diuron. CANEGROWERS realise this is not considered under section 14 (registration) and 34 (reconsideration) of the legislation informing the APVMA review (Agricultural and Veterinary Code Act 1994), however if the tools for growers to operate are removed without realistic alternatives, it will be likely to lead to perverse outcomes for water quality as growers may revert to mechanical cultivation.

CANEGROWERS are concerned the suspension of diuron will place avoidable burden on growers, their weed management systems and practices. The last thing the sugarcane industry would want to see is a perverse outcome to both the production system and the environment.

CANEGROWERS have gone through the *Environmental Assessment on Diuron July 2011* (APVMA, 2011) and has been working with the University of Sydney, Nufarm Australia Ltd and Farmoz Pty Ltd on a detailed technical response. CANEGROWERS has also been working with industry groups to provide further information on diuron.

CANEGROWERS have raised several concerns about the process with the APVMA. Some of these have been addressed, however there are still several issues that require further consideration for diuron products and rates by the APVMA before a final decision is made:

1. Critique provided by University of Sydney on the APVMA modelling
2. New information on diruon metabolites not present in the 2005 Review.
3. Evaluation of the practice change undertaken by the sugar cane industry since the 2005 review. The sugarcane industry already uses reduced rates of diuron in its farming system.
4. Evaluation of the Queensland State Government's Reef Regulations (Great Barrier Reef Protection Amendment Act 2009) that targeted residual PSII herbicides particularly diuron, where the rate of application was reduced to 1.8kg of active constituent per hectare per year.

5. Evaluation of the effectiveness of the $200 million Reef Rescue program (Australian Government, 2008) that sits under the Reef Plan (Australian Government, 2003). Both have targets to improve water quality and reduce herbicides by 25% and 50% respectively. Herbicides of interest under the programs include diuron.

Review of the APVMA diuron report issued in July 2011

CANEGROWERS has reviewed the APVMA's report on diuron and considered the scientific argument presented in the APVMA's report needed further critique from an independent expert. CANEGROWERS are concerned that the rates of application provided for primary and secondary streams are overprotective and unworkable in terms of efficacy of product at reduced rates. CANEGROWERS also considered the modelling behind these figures did not represent the characteristics of a sugarcane farming system.

CANEGROWERS had previously worked with Professor Ivan Kennedy from the University of Sydney on the 2005 review of diuron. In seeking his services for the 2011 review, CANEGROWERS became aware that Nufarm and Farmoz were working on the same issue. CANEGROWERS joined with them to commission the University of Sydney to conduct a review of the APVMA Report issued in July 2011, "Diuron review - report for immediate action volumes 1 and 2: The reconsideration of the active constituent diuron, the registration of products containing diuron and approvals of associated labels"

The key findings in the 2011 APVMA review of diuron were:

- There is an unacceptable risk from runoff to algae and aquatic plants in primary streams at rates of application > 160 g ha^{-1}
- There is an unacceptable chronic risk to birds from application of diuron at rates > 350 g ha^{-1}
- There is an unacceptable risk from runoff to algae and aquatic plants in secondary streams at rates of application > 900 g ha^{-1}
- There is uncertainty about the potential for diuron and its metabolites in pore water to pose risk to sediment algae and rooted aquatic plants

In the review of APVMA's diuron report, the University of Sydney was asked to consider the following:

1. The appropriateness of the methodology and modelling used by the APVMA (DSEWaH) in the review report;
2. Any scientific work which may have been overlooked in the environmental assessment;
3. The validity of the assumptions and the conclusions reached in the environmental assessment and review report;

Outcomes of the University of Sydney review

CANEGROWERS support the analysis conducted by the University of Sydney in its conclusion that the APVMA's assessments, particular the first three, are excessively protective in their approach, being based on assumptions that are unjustified or inconsistent.

CANEGROWERS refers to the report "Independent review of APVMA's Diuron review report for immediate action volumes 1 and 2 the reconsideration of the active constituent diuron, the registration of products containing diuron and approvals of associated labels" (Kennedy *et al*, 2011) for scientific argument, conclusion and recommendations (appendix 1).

CANEGROWERS have provided selected excerpts from the executive summary from Kennedy *et al* 2011 below.

From our objective analysis of this information and the methods used we conclude that these findings are excessively protective, particularly for primary streams, using assumptions that are either not well justified or inconsistent with existing facts or newly published information. We do not consider that a sufficient case has been made that the current reduced rate of 1.8 kg per ha per annum for broad acre crops is excessive, although significant changes in product labelling and mitigation practices for various crop uses are warranted, to minimise risk. This opinion is based on the following conclusions made from the evidence available:

- The use of diuron exposure data from the Murrumbidgee Irrigation Area as surrogate for contamination of primary streams Australia wide is not adequately justified and the maximum concentrations observed are biased. Furthermore, some degree of dilution needs to be included in the definition of a primary stream as well as secondary streams, to acknowledge diversity in farming practices and sources of runoff water, both temporarily and spatially, as an encouragement to mitigation practices and better management.

- The methods used for calculating risk in the Diuron Environment Assessment document are inconsistent with respect to the order of the percentiles used for exposure and ecological protection. Furthermore, information and field data can be produced showing that the new model used to estimate diuron in runoff is overprotective, underestimating Kd values when integrated over time and overestimating diuron's half-life.

  Several layers of such protection lead to an excessively precautionary conclusion that 160 g of diuron per ha is a no-effect level for broad acre agriculture. Our table of Q-value re-calculations suggests that overprotection by a factor of at least 5-10 in application rates possible to achieve no effect is involved.

- Regarding exposure of birds to diuron, the EFSA (2008) document on which the risk assessment for exposure is based also gives maximum residue concentrations and food categories derived from a more recent and complete review, but these were not used in the DSEWPaC/APVMA assessment.

- The risk to secondary streams has also not been clearly established, even at annual application rates limited to 1.8 kg per ha. Data measuring the effect of decreasing this rate from 3.6 kg per ha since 2006 has not yet been collected or analysed. Some questionable assumptions indicated in the APVMA Review documents weaken the case and this should be re-assessed.

- The concern regarding surface and pore water was strongly influenced by claims that diuron's metabolites (DCPMU, DCPU, DCA and MCPDMU) could be up to three times more toxic than the parent diuron. However, we show this claim is spurious; although DCPMU retains almost half diuron's herbicidal activity judged by its effect on algal cell growth, the metabolites are increasingly less toxic to plants as its substituents are altered and there is no evidence that they persist or accumulate.

  Significant levels of DCPMU residues have not been found in primary or secondary streams and the Kd values for binding of diuron and DCPMU to sediment are both likely to be greater than 50 resulting in Q values for pore water much less than 1.

- Given these reservations, we conclude that the case for Australia to adopt the most stringent regulatory conditions world-wide for diuron cannot be justified on scientific grounds, particularly in

the absence of direct evidence of deleterious effects. Convincing ecological evidence for the effects proposed in primary and secondary streams in the APVMA review simply does not exist in Australia and several possibly mitigating effects should be considered. To adopt such an extreme precautionary policy for diuron is not in Australia's interest, would be fraught with serious issues for other agrochemicals with similar toxicities and the general application of tools for weed control. Australia has largely adopted minimum-till agriculture in the past 25 years and the need to return to widespread soil cultivation and land in fallow for weed control, based on assuming 'worst-case' effects for diuron, would be even more environmentally damaging. Some moderate restriction on the use of diuron is justified, allowing much of its undoubted benefit to be retained.

- **CANEGROWERS supports the work undertaken by the University of Sydney and the counter-argument it brings to the risk diuron poses to the environment. CANEGROWERS recommends that APVMA fully consider this work in determining new levels of unacceptable risk to primary streams, birds and secondary streams.**

- **CANEGROWERS supports the continued use of diuron at a rate of 1.8kg active constituent per hectare per year.**

CANEGROWERS also provides the following information in addition to the work of University of Sydney

Primary stream modeling

CANEGROWERS draws attention to page 95 of APVMA's report and the suggestion that the most relevant data for primary streams comes from NSW monitoring:

"Possibly, the most relevant data for primary streams comes from NSW monitoring. During the four years from July 1997 to June 2001, water monitoring of drainage water at 15 sites in the Murrumbidgee Irrigation Area was undertaken and showed several detections of more than 20 µg/L. From a total of 548 samples, the 75th, 90th, 95th and 99th percentile values were reported as 0.4, 0.9, 2.26 and 12.6 µg/L respectively. More recent data (2004–06) at these sites gave similar results, although the highest level detected was 13.2 µg/L.

There are fundamental concerns with considering agricultural drains as being surrogates for primary streams in terms of flow paths from paddocks, flow rates in the drains and residence time in the drains will vary and therefore affect concentration.

The use of first flush data from run-off from a citrus orchard is difficult to extrapolate to the situation that exists in sugarcane farming, which is a five year crop that is harvested annually and ratooned for the following season. The report describes diuron application rates in the citrus orchard as 4.5kg ai/ha, which is more than double the rates used in sugarcane farming (1.8kg ac/ha) when applying as a pre-emergent in plant cane at out of hand stage.

It would also follow that the farming system used in citrus orchards would provide a far greater propensity for run-off than in sugarcane farming. Sugarcane farms tend to use laser levelling of blocks to manage run-off, grassed headlands adjacent to blocks which slows and can treat run-off, green cane trash blanketing within blocks that prevents erosion and sediment movement and finally the use of sediment traps, recycling pits and tail-water recycling pits that reuse water and capture sediment.

CANEGROWERS question:

- **The appropriateness of agricultural drains being surrogates for primary streams**
- **The runoff characteristics from citrus orchards being representative of annual cropping such as sugarcane farming**
- **The difference between application rates of sugarcane and citrus orchards**

Birds

Data on feeding diuron to two species of birds, bobwhite quail and mallard duck are used to gauge impact of the compound on bird health and mortality. The two species show different effects – one a chronic mortality and the other an effect on oviposition. While CANEGROWERS recognises that they are used as indicators, neither species occurs in Australian sugarcane areas.

The use of diuron as a residual herbicide in sugarcane blocks is, by its very nature, designed to prevent weeds from occurring. Therefore, weed seed would be extremely limited for birds to feed on.

Secondly, diuron when used as a knockdown or spot spray, is generally used to treat weeds at early stages of development. This provides more effective management. This action would also have the effect of preventing weed seed development. Additionally, weeds treated with herbicide would show the effect after a period of time. These would be considered less palatable in preference to fresh food sources.

Weed seed could also come from edge of blocks from grassed headlands. However management of these areas through slashing is undertaken by growers on a regular basis for farm management, safety, rat control and compliance with the Queensland Government's Reef Regulations.

Rats rely on high-protein feed from grass and weed seeds to be able to breed and reducing weed growth around the farm reduces food source and harbourage (Hogarth & Allsopp, 2000). Therefore these areas would be limiting in terms of seed availability.

The Reef Regulations has provisions for growers to have a 5 m EVTA (effective vegetated treatment area) for the treatment of run-off containing PSII herbicides (including diuron) regulated under the Reef Regulations (DERM, 2010).

From the CANEGROWERS questionnaire, growers have noticed a wide variety of species occurring in cane blocks with the consistent species being reported as curlews and plovers.

CANEGROWERS question:

- **Which bird species could acquire significant levels of diuron from a sugarcane field given the effect of herbicides on weeds and management practices within the industry?**
- **The relevance of the findings to species occurring in sugarcane fields**
- **What species of birds occurring in sugarcane fields or off-site areas are likely to be impacted by diuron residues?**

Diuron use and assumed risk

In the APVMA diuron review documents, it was stated that the total amount of diuron used in Australia for agricultural purposes is more than 2000 tonnes per annum and sugarcane accounted for approximately 350 tonnes. For 1996 it was 197 tonnes per annum of diuron and records of average sales figures for 2002–03 suggest this would appear to have increased considerably. The report goes on to say that during

this time, the area of replanted cane increased from the normal 15 per cent of total cane area to 30 per cent, which may have led to an increased use of diuron during this time.

CANEGROWERS notes that a severe disease in a major variety (orange rust in Q120) caused significant replanting at this time. Since then, replanting rates have reduced, first in response to poor prices but more lately because of improvements in soil structure caused by changes in farming practices of which use if diuron is an integral part

CANEGROWERS do agree that between 1997 and 2003, the area of cane increased and reached a peak of 424,350 hectares in 2000. However this has been continually reducing since 2003 as shown in the graph below. Therefore it is fair to say that the reduction in area would have led to an overall decrease of diuron.

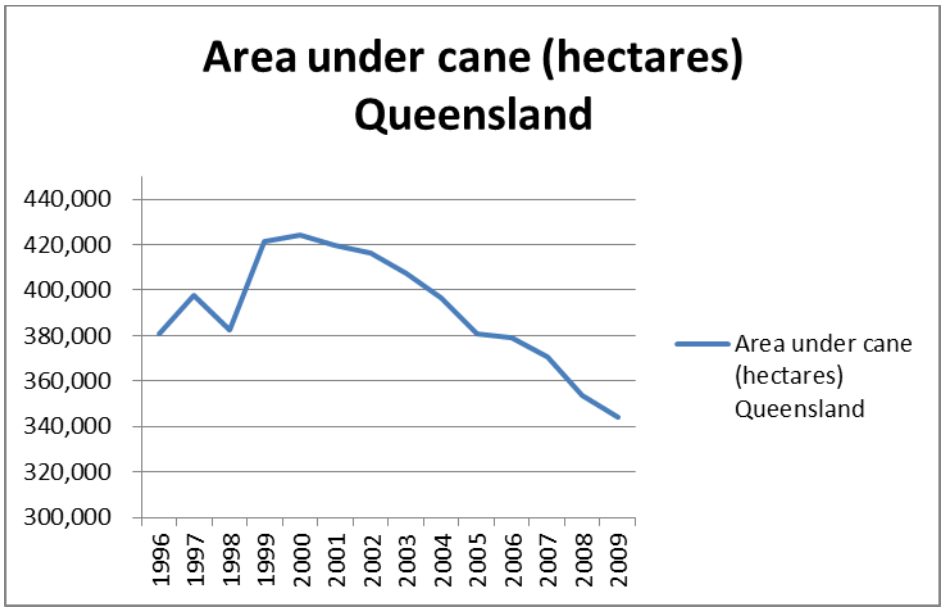

Figure 1: Area under cane (hectares) in Queensland. Source: Australian Sugar Milling Council 2011.

Diuron has been used for over 30 years in sugarcane areas and in the past, at application rates much higher than currently used. If, as the models suggest, diuron is of high risk to the environment, then we question why have these effects not been seen and documented. In light of the lack of evidence of adverse effects, it would be reasonable to conclude that the modelling used by APVMA should be reviewed.

- **CANEGROWERS recommends that APVMA review the modelling and give due consideration to the work undertaken by University of Sydney.**

CANEGROWERS questionnaire on diuron use in the sugarcane industry

For a number of years now, CANEGROWERS have been saying that growers are using half the label rate of diuron. This is supported by BSES extension staff and extension staff from local Productivity Services Boards.

To further support this, CANEGROWERS developed a questionnaire on diuron usage within the sugarcane industry to confirm the lower usage rates and to better understand the circumstances behind the application of products containing diuron.

Methodology

The CANEGROWERS diuron questionnaire contained 21 questions on diuron use, rates and application methods and sought further information on weed species targeted and bird species found in cane blocks (Appendix 2).

The questionnaire was distributed it all CANEGROWER members via the *Australian Canegrower* magazine and electronically through the networks of the district CANEGROWERS offices throughout Queensland. Response to the questionnaire was voluntary.

Completed questionnaires were returned to the CANEGROWERS Brisbane office via post, fax or email and were collated into a Microsoft Excel spread sheet. CANEGROWERS received a total of 226 questionnaires which represented 6.5% of its membership base. The data was considered a randomised sample and large enough to be statistically valid.

As the most important data sought was usage rates, the data was validated to ensure that information provided on diuron use rates was in fact product rate and not the active constituent rate.

The responses were tabled and ranked from highest to lowest rates. These were then checked against product rates and product type (I.e. Velpar K4, Diurex 900). From this, 22 growers who completed the questionnaires were contacted to check the rates provided in the questionnaire were product and not active constituent. Of these 22 growers, two provided active constituent rates and these were amended to reflect the product rate and the remainder of the data scrutinised. This process validated the data provided by growers and gave CANEGROWERS a high level of confidence the rates provided were product rates.

The rate data was then converted to active constituent per hectare. This was done by taking the product rate provided and multiplying it by its maximum active constituent (ac). The ac was identified by the associated product name provided by the grower in the questionnaire. For example if the product was diurex 900 and its active constituent was 900g/kg and the product rate applied was 2kg/ha, then the resulting active constituent rate would by 1.8kg ac/ha.

CANEGROWERS took a conservative approach to the data by using the highest rates. If only one product rate was given, then that was used, however if a product rate range was provided, CANEGROWERS selected the highest rate.

The active constituent rates were sorted from smallest to largest. The rates were then rounded to the nearest 0.25 increments to produce use patterns. I.e. a rate of 0.225 was rounded up to 0.25 and a rate of 0.3375 was rounded down to 0.25. Increments of 0.25 were considered the most suitable to present the data in graphic format. These 0.25 increments were counted, subtotalled and graphed to provide the histogram and use graphs. This was completed for rates used for plant, ratoons and whole of farm (figures 2 to 7).

The whole of farm use rates were determined using the highest application rates for plant and ratoon respectively. To determine whole of farm, a formula was developed based on the typical crop cycle for cane where plant is done in the first year and ratoon is for the following 4 years. The formula multiplied the plant rate by 1 (1 year) and the ratoon rate by 4 (4 years) to provide a farm use over a 5 year cycle.

Results and discussion

The data indicated that 96% of respondents used diuron as a herbicide to manage weeds on their sugarcane farms. Opinion from extension organisations including BSES and Productivity Services Boards within the Queensland sugarcane industry estimated that approximately 80% of growers use some form of diuron product during a typical weed management cycle on their farms. This was supported by BSES Northern and Southern Extension Leaders in discussions with local extension offices from BSES, Productivity Services Boards, CANEGROWERS District Managers and resellers in the respective areas.

In the Herbert River district (Wet Tropics region), BSES estimate 80% of growers are using some form of diuron in their weed management systems. This figure is also supported in the Burdekin and Central regions (Mackay Whitsunday region). Advice from CANEGROWERS District Managers also indicates diuron products are widely used with the Tablelands assessing 75% of growers using some form of the product, Tully 90%, Mossman 95% and Maryborough 80%.

- **CANEGROWERS concludes that diuron products are used by more than 80% of the industry. This demonstrates the importance of the product to the sugarcane industry.**

On average growers apply diuron once on plant cane and once on ratoon cane. However some growers apply diuron twice in plant and or ratoon at lower rates or through spot spraying.

- **CANEGROWERS concludes that on average growers apply diuron once on plant cane and once on ratoon cane.**

Data from the CANEGROWERS survey is shown in figures 2 to 7 below.

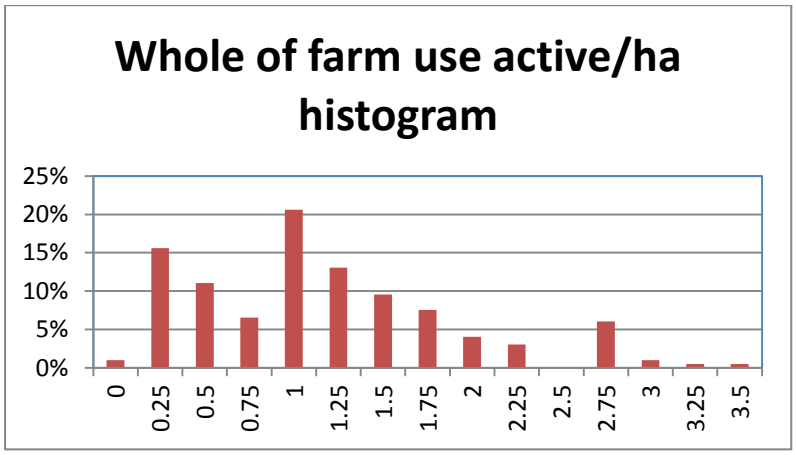

Figure 2: Histogram showing diuron active constituent use for whole of farm

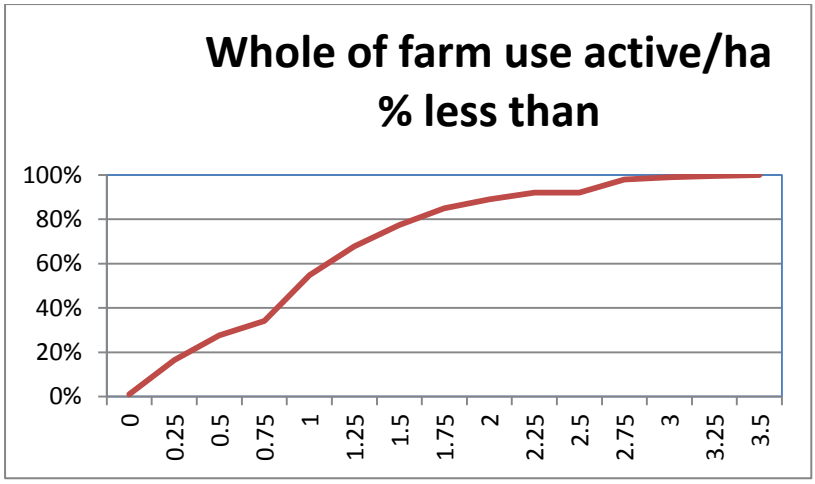

Figure 3: Chart showing % growers and diuron active constituent use rates for whole of farm.

The data shows that 85% of growers who use diuron do so at rates of 1.8kg ac/ha or less.

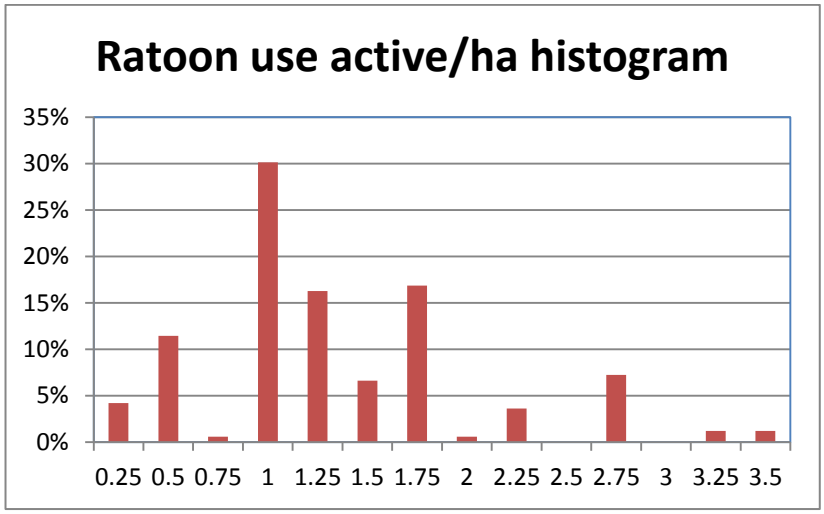

Figure 4: Histogram showing diuron active constituent use for ratoon

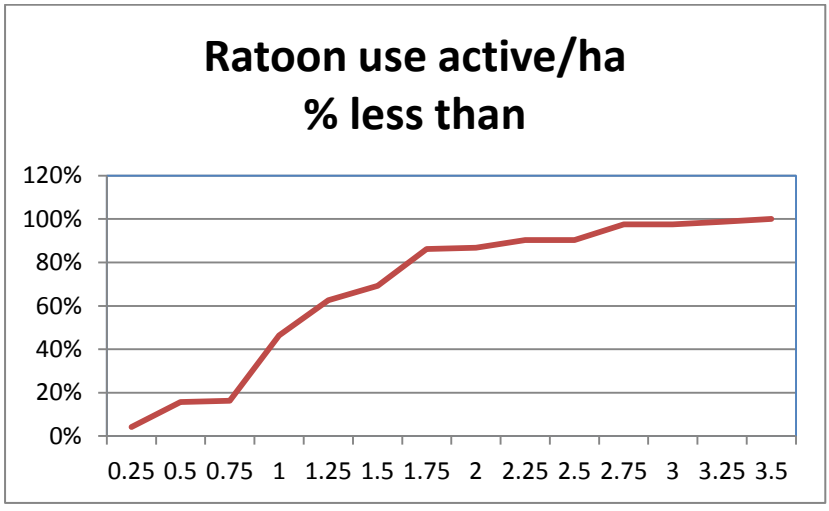

Figure 5: Chart showing % growers and diuron active constituent use rates for ratoons

86% growers who use diuron do so at rates of 1.8kg ac/ha or less for weed management in ratoons.

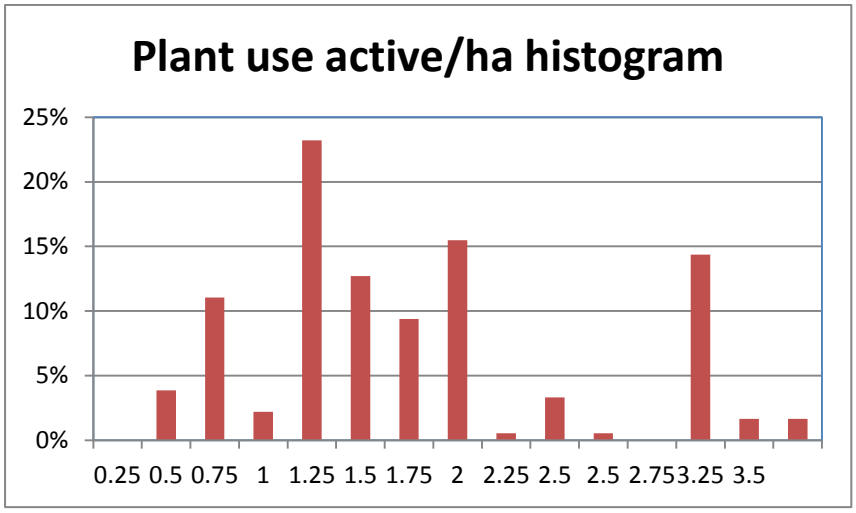

Figure 6: Histogram showing diuron active constituent use for plant

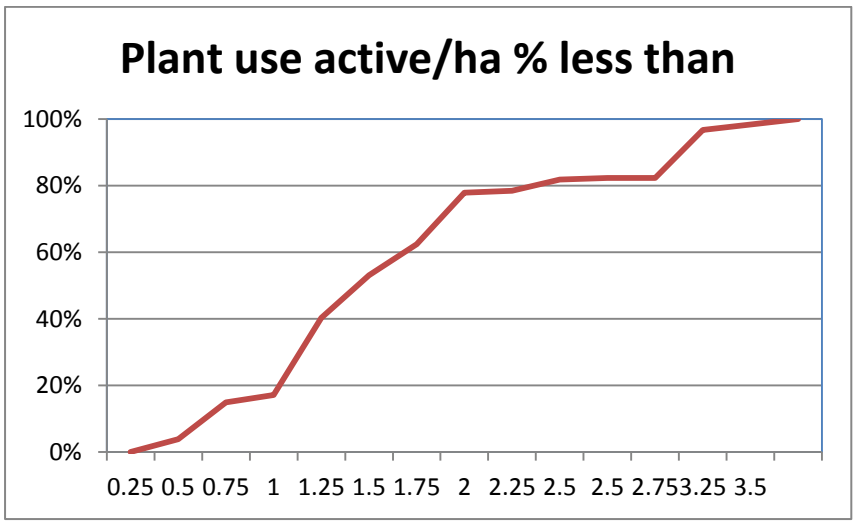

Figure 7: Chart showing % growers and diuron active constituent use rates for plant.

78% of growers who use diuron do so at rates 1.8kg ac/ha or less for plant.

Results indicate that 85% of growers who use diuron do so at rates of 1.8kg ac/ha or less across the whole of farm (plant and ratoon). This supports CANEGROWERS claim of reduced rates for diuron to half the label rate.

- **CANEGROWERS concludes that diuron is generally used at rates of 1.8kg ac/ha, which is half the current label rate. This indicates that it is efficacious at these rates.**

Weed spectrum

Four categories of weeds are found in Australian cane fields; grasses, sedges, broad leaves and vines. Each is important and no one group dominates in terms of importance (Hogarth & Allsopp, 2000). Diuron is effective against a broad range of grass, broadleaf weeds and vines that commonly occur across cane growing districts.

By itself, diuron controls barnyard grass, crowsfoot grass, guinea grass, summer grass, barley grass, ryegrass, wild oats, cobbler's pegs, pigweed, Prince of Wales feather, amaranthus, fat hen, mustard, sow thistle, capeweed, wild radish and wild turnip.

In combination with other products (e.g. Velpar K4) control extends to include bluetop, coast button grass, common sida, phyllanthus, rattlepod, Setaria spp., square weed, thickhead, bellvine, common morning glory, cupid's flower (star of bethlehem), common sensitive plant, passion fruit vine, pink convolvulus, red convolvulus, giant sensitive plant, itch grass, wild rose, centro, pink burr and stinking passion flower.

Diuron is added to other mixes to be able to gain effective control of hard to manage species such as green summer grass (*Brachiaria subquadriparia*) and guinea grass (*Panicum maximum*). It enhances the results achieved with gramoxone and enables a complete kill to be achieved on larger plants as well as for a wider range of species.

- **CANEGROWERS concludes that diuron is an important product to manage the broad weed spectrum in the sugarcane industry**

Products containing diuron, rates of application and tank mixes.

Diuron is not generally used as a standalone product to achieve pre- emergent control of grass and broadleaf weeds within the sugarcane industry. This is supported by the CANEGROWERS survey, which showed only 12% of the respondents used diuron as a stand-alone product. 43% of respondents used diuron as a spike with other herbicide products and 81% used it as a mix with other herbicide products.

- **CANEGROWERS concludes that diuron is mainly used as a mixture with other herbicide products. This demonstrated the importance of the product to the sugarcane industry.**

Diuron is typically used in Velpar K4 at rates of between 1 to 2kg ac/ha as a single application per crop cycle in plant cane crops as a blanket application.

Diuron's combination with hexazinone (Velpar K4, Bobcat Combi, Barrage) gives growers a very robust product with a reliable period of pre-emergent weed control, even under the extreme wet and dry cycles of the wet tropics. This product provides broad spectrum control of grass, vines and other broadleaf weeds and manages even the hard to control species that a number of other products fail to control.

Data from 2007 Farm Productivity Assessments (FPA) in the Burdekin show 48% of growers use Velpar K4 in plant cane and 63% in ratoon cane. 2007 FPA's from the Central region show 26% and 38% of growers use Velpar K4 in plant and ratoon cane respectively (Source BSES).

The addition of 0.5 to 1kg of diuron to a number of products and or mixtures gives a reliable, cost effective method of managing hard to kill/control grass species. Diuron is used in mixtures with Gramoxone, MSMA, Gesapax Combi, Actril DS, and Amigan to improve efficacy of products and to also broaden the range of grass weeds controlled.

The loss of diuron would dramatically reduce the effectiveness of these mixtures, resulting in increased applications of other less effective combinations of products at a higher overall cost for herbicide application to the growers.

To support these uses, 100% of respondents in the CANEGROWERS survey said diuron was effective in controlling weeds.

- **CANEGROWERS concludes that diuron is an effective product in controlling weeds and its loss would lead to greater weed pressure, more herbicide substitution and greater use of products such as paraquat.**

Diuron is typically applied in the sugarcane industry as follows:

- **Gramoxone + Diuron** at 0.5kg/ha - Spot and edge spraying. Some blanket applications to whole plant blocks. Occasional use for strategic spraying in ratoons (not whole block).
- **MSMA + Diuron** at 1kg/ha – Spot and edge spraying. Limited blocks treated as blanket application of whole block in plant cane. Some strategic applications to patches in ratoon cane.
- **Gesapax Combi + Diuron** at 0.5kg/ha - Blanket application of some blocks of plant cane and occasionally to target patches in some ratoon blocks.
- **Actril DS** + **Diuron** at 0.5-1kg/ha – Spot spraying and some blanket applications in plant cane. (limited)
- **Amigan + Diuron** at 0.5kg/ha- When used as a blanket application in some plant cane blocks.

Tank Mixes in the industry also include:

- **Paraquat** (250g/L) at 1.2 – 1.6 L/ha plus **diuron** (900g/kg) at 0.275 to 0.5 kg/ha
- **Gesepax Combi** (atrazine (250g/L) plus ametryn (250g/L)) at 6L/ha plus flowable **diuron** (500g/L) at 2L/ha.
- **Velpar K4** (diuron (468g/kg) plus hexazinone (132g/kg)) at 0.6-1.2 kg/ha plus **paraquat** (250g/L) at 1.2 to 1.6 L/ha.
- **MSMA** (MSMA (800g/L) at 3L/ha plus **diuron** (900g/kg) at 1.1 kg/ha

These uses and products are supported by advice from BSES extension staff and publications including Herbicide residuals (Callow, 2005) and Herbicide Manual (O'Grady & Sluggett, 2000).

Table 1: Current label directions for enhancement of control by other herbicides with diuron.

Products	**Actives**	**Product Rate/Ha (when used with diuron)**	**Added Diuron rate/Ha**	**Purpose of adding diuron**
Actril®DS	577 g/L 2,4-D present as ethyl hexyl ester + 100 g/L IOXYNIL present as the octanoate	1.0 to 1.5 L	At recommended rate.	To control seedling grasses and more advanced broadleaf weeds.
Balance® 750 WG	750 g/kg ISOXAFLUTOLE	200 g	1.6 kg diuron (900 g/kg)	To control vines (*Ipomoea spp*.) as well as grasses and broadleaf weeds.
Clincher® Plus Chaser® Metolachlor 960 + ATRAZINE	960 g/L METOLACHLOR + 900 g/kg atrazine	1.65 to 2.7 L + 1.5 to 2.5 kg	1.0 L diuron (500 g/L)	To control broadleaf weeds and grasses that have emerged and are in the 2 to 4 true leaf stage.
Compatriot®	533 g/kg DIURON 67 g/kg HEXAZINONE	2.5 to 3.38 kg	(part of product) (1.33 to 1.80 kg ac diuron)	Controls a range of annual and perennial grasses and broadleaf weeds.
Dual Gold + ATRAZINE	960 g/L S-METOLACHLOR + 900 g/kg atrazine	1.1 to 1.8 L + 1.5 to 2.5 kg	1.0 L diuron (500 g/L)	To control broadleaf weeds and grasses that have emerged and are in the 2 to 4 true leaf stage.
Daconate®	800 g/L MSMA	3.0 L (boom spray)	1.1 kg/ha diuron	To control Guinea

MSMA Herbicide		1.0 L /100L (spot spray)	(900 g/kg) 550 g diuron (900 g/kg)/100 L	grass (*Panicum maximum*)
Gesapax Combi® 500SC Combo® SC	250 g/L ATRAZINE 250 g/L AMETRYN	6.0 L	2.0 L diuron (500 g/L)	In situations where Green Summer Grass (*Brachiaria spp*) is present.
Gramoxone® Inferno® Nuquat® 250 Para-Ken 250 Paraquat 250 Boa®	250 g/L PARAQUAT present as PARAQUAT DICHLORIDE	1.2 to 1.6 L	0.275 to 500g (900 g/L) 1.0 kg (900 g/L)	Enhancement of control of grass and some broadleaf weeds: Up to 5 cm high Up to 10 cm high
Primextra Gold	290 g/L S-METOLACHLOR 370 g/L ATRAZINE	3.6 to 6 L	1.0 L diuron (500 g/L)	To control broadleaf weeds and grasses that have emerged and are in the 2 to 4 true leaf stage.
SPRAY.SEED® 250 EOS Revolver Speedy 250 Spray & Sow® Spray-Out 250 Spray-Plant 250	135 g/L PARAQUAT present as PARAQUAT DICHLORIDE 115 g/L DIQUAT present as DIQUAT DIBROMIDE	1.2 to 1.6 L	275 g/ha diuron (900 g/kg) 500 g diuron (900 g/kg) 1 kg diuron (900 g/kg)	To enhance activity of SPRAY.SEED® 250. Seedling broadleaf weeds and seedling grasses: Up to 5 cm high Up to 10 cm high
Stomp® 440 Panida Grande™ Rifle® 440	440 g/L PENDIMETHALIN	2.25 to 3.4 L	1.7 kg diuron (900 g/kg)	To control Blue Top (*Ageratum houstonianum*) as well as annual grasses.
Stomp® Xtra	455 g/L PENDIMETHALIN	2.2 to 3.3 L	1.5 kg ac diuron	To control Blue Top (*Ageratum houstonianum*) as well as annual grasses.
Velpar® K4™DF® Barrage Bobcat® Combi WG	468 g/kg DIURON 132 g/kg HEXAZINONE	600 g to 3.85 kg 1 kg/100L as spot spray	(part of product) (280 g to 1.8 kg ac diuron)	Controls a wide range of annual and perennial grasses, broadleaf weeds and vines in established Sugar Cane. Guinea grass

The retention of diuron enables it to be mixed with other herbicides such as ametryn, atrazine, paraquat, hexazinone to improve their effectiveness and reduce the rate required for these products. For example: addition of 1.0 kg/ha diuron to a combination of ametryn/atrazine reduces the rate required by 2.0 L/ha; the addition of 0.275 kg/ha diuron to paraquat reduces the rate of paraquat by 0.4 L/ha. This is an effective herbicide management strategy.

Time of application

Normal time of application in the Herbert River district is from when planting commences in April through to May depending on seasons, until November and December.

Spot spraying and edge spraying may continue during the January to March period depending on the severity of the wet season and the access to blocks that have suitable application conditions.

In the Burdekin and Central regions, for plant cane diuron applied with Gesepax Combi is mostly undertaken in the March to April or September to October period. There is some application as Velpar K4 in the November to December period.

Application methods

Diuron is applied as a directed application under the canopy using Irvin legs, droppers and to some extent shielded/hooded sprayers. From the CANEGROWERS survey, 80% of growers apply diuron using Irvin legs, 11% with shielded sprayer and 30% with a broad boom sprayer. Growers tend to have several pieces of spray application equipment.

Flat booms with low drift or Air Inducted nozzles are typically used to apply some of the mixtures to plant cane crop as a blanket/complete coverage application. From the CANEGROWERS survey, 30% of growers use floodjet nozzles, 46% use air inducted nozzles and 35% use flat fan. Growers have different nozzles on different spray equipment or can change nozzles.

- **CANEGROWERS concludes that diuron is applied with several different spray rigs and nozzle configurations. The use of Irvin legs and air inducted nozzles is favoured but other application methods should continue to be available.**

As cane has a 5 year crop cycle, the cane farm consists of plant blocks, ratoon blocks and fallow blocks. Typically, the plant is 15-20% of the farm, ratoons 60-70% and fallow 15-20%. From the CANEGROWERS survey, 52% respondents apply diuron to the whole block, 54% to the interspace and 35% spot spray.

Diuron in also applied in a spray tank mixture where a hand gun or a very high volume single nozzle is used to spot spray grass and weed patches. It is also used for band spraying a 1 m wide section around the edges of cane blocks to prevent the incursion of perennial grasses (e.g. green couch) that is grown on headlands to meet the 5m Effective Vegetated Treatment Areas that are required under Queensland Government Reef Regulations.

Spot spraying to manage guinea grass is generally applied by hand-gun to a maximum 1-5% of the total farm area (personal comments BSES Northern Extension Leader and the BSES Southern Extension leader). The guinea grass stool can get to approximately 1m in area and depending on infestation and seasonal conditions there could be 1 stool per 20 m or 100 stools in a paddock. Diuron is used at a rate on 1kg/100L water and generally mixtures of diuron / gramoxone or velpar K4 (diuron-hexazinone)/gramoxone or diuron/gramoxone/2,4-D are used for spot spraying.

Relative cost of Diuron and alternatives

At about $13.6 /ha diuron is still a very cost effective herbicide to have as a part of a tool box of herbicides for farmers to manage weeds.

A cost comparison between Velpar K4 and other “softer” replacement residuals is below.

Velpar K4 @ 1.5-2kg/ha = $32- $48/ha
Possible replacements would be as follows but would give reduced time of pre-emergent control:

- Flame @ 400ml/ha + Stomp Xtra @ 3.3L/ha = $ 103/ha
- Flame @ 300-400ml/ha + atrazine @ 2.2kg/ha = $ 102/ha

- Balance @200g/ha + atrazine @ 2.2kg/ha = $102/ha
- Soccer @ 1.5-2.0kg/ha + Balance @ 150-200mls/ha = $126-168/ha
- Soccer @ 1.5-2kg/ha + Stomp Xtra @ 3.3L/ha= $ 105-126/ha

Therefore to replace Velpar K4 even at the local usage rate, that is significantly below the product label maximum of 3.8kg/ha, the cost of pre-emergent weed management in plant cane fields would at least double and in most cases treble.

Until the advent of green cane trash blanket harvesting systems, virtually all cultivation for weed control on cane lands was by mechanical means. The use of a trash blanket from green cane harvesting brought many benefits to the industry. These included:

- Dramatic reduction in soil erosion and run-off
- Recycling of nutrients
- Improved soil structure and moisture holding capacity
- Reduced weed infestation

As essential part of this farming system is the ability to control weeds that do emerge chemically, rather than mechanically. Farmers have developed specialised high clearance spraying equipment to allow passage of tractors through the field to allow weed control to continue until the cane is at the out-of-hand stage. As noted above, diuron is a vital part of the armoury to maintain this beneficial farming system. There are significant concerns if diuron is no longer available, farmers would revert to mechanical cultivation which would see increases in soil loss and run-off and declines in water quality.

- **CANEGROWERS concludes that the loss of diuron would place a significant cost burden on growers. This could lead to alternative weed management systems such as cultivation which could lead to perverse water quality outcomes.**

Record keeping

Growers are keeping records of herbicide applications and use to comply with Reef Regulation requirements, as well as complying with the various other state and federal pieces of legislation. In early 2010 CANEGROWERS printed and distributed 5000 Farm Chemical Record Books to growers for record keeping. From the CANEGROWERS survey, 95% of respondents keep records on chemical use.

Chemical accreditation numbers

CANEGROWERS has been supporting chemical training since the establishment of Chemcert in the early 1990's. With the introduction of Reef Regulations there is now the requirement to obtain the 3 competencies to apply PSII herbicides including diuron. These are:

- RTC3704A: Prepare and Apply Chemicals
- RTC3705A: Transport, Handle and Store Chemicals
- RTC3401A: Control Weeds

Table 2: Chemcert training figures for sugarcane from July 2006 to June 2011. Source: Chemcert Training Queensland / Farmsafe Queensland 2011.

Region	Total	Jul06-Jun07	Jul07-Jun08	Jul08-Jun09	Jul09-Jun10	Jul10-Jun11
	2			1	1	
BRISBANE	34	21	10		2	1
BURNETT	1					1
FAR NORTH	526	67	26	33	390	10
FITZROY	1					1
MACKAY	223	10	2	45	166	
MORETON	13	7	1	2	2	1
NORTH EAST	4	1		1	2	
NORTHERN	964	47	50	118	629	120
WIDE BAY BURNETT	292	38	32	148	55	19
Totals		191	121	348	1247	153
Five year period to 30/6/2011	2060					

In 2010 Mackay CANEGROWERS partnered with the Australian Agricultural College Corporation (AACC) to deliver chemical accreditation training to a total of 862 participants. (Source - Mackay CANEGROWERS 2011).

From the CANEGROWERS survey, 97% said they have chemical accreditation through Chemcert or equivalent.

- **CANEGROWERS concludes that the majority of growers have undertaken chemical training over the last 5 years. Sugarcane growers have been voluntarily undertaking chemical training since it was first promoted by CANEGROWERS.**

Risk mitigation measures

CANEGROWERS consider the following farming systems and practices can manage the potential risk to the environment from diuron.

Product

1. A maximum rate of 1.8 kg ac/ha/year for diuron.
    a. This is half the registered label rate for sugarcane and is based upon comprehensive use data throughout the industry.
    b. This rate still provides broad spectrum weed control
    c. This rate enables diuron to be mixed with other herbicides
2. A review of label use and conditions by registrants to support the 1.8kg ac/ha rate.

Grower

1. Chemical accreditation and training for users of diuron products
2. Regular calibration of spray equipment
3. Suitable nozzle selection and replacement regime
4. Growers utilise BOM radar where appropriate weather forecasts before spraying
    a. DERM requires a rainfall run-off risk assessment before the application of regulated PSII chemicals (diuron) in the regulated catchments under Reef Regulations.

5. Growers keep records of use and application
6. Weed management plans

Farming system

1. Harvesting green and the use of green cane trash blanket (GCTB).
    a. This reduces risk of sediment loss from sugarcane paddocks.
    b. All regions except the Burdekin cut green and use GCTB.
2. The use of sediment traps and recycling pits to capture and treat run-off and irrigation
    a. Burdekin areas irrigate and recycle their water on farm
3. Laser levelling of blocks to manage watershed
4. Grassed headlands, modified drains and grassed swales to treat their water.
5. Minimum to no-til farming system with controlled traffic.
6. The development and implementation of integrated weed management systems

Points 1 & 5 are supported by research by Masters et al (2008) on sediment, nutrient and herbicide run-off.

Industry programs

1. Continued engagement and support for Federal Governments Reef Rescue program
    a. Incentive based program incentivising practice change in nutrient, sediment and chemical farm management practices
2. Compliance with Queensland Government's Reef Protection Package (Reef Regulation)
    a. Compliance based program regulating practice change in nutrient, sediment and chemical farm management practices
3. Continued support for R,D&E on management practices and systems that focus on continual improvement and sustainability using the principles of profitability, productivity and environmental stewardship.
    a. Development of improved farm management practices and systems
    b. Development of new products
4. Development and implementation of a sugarcane Best Management Practice Framework (Cane BMP)
    a. This is currently being developed by CANEGROWERS

- **CANEGROWERS concludes that industry practices, products and systems have considerable reduced the potential risk to the environment from diuron. CANEGROWERS believe the industry is continually improving through R,D&E and these changes need to be acknowledged and assessed in the review of diuron.**

Best Management Practice in risk mitigation

Agreed principles on best management practice must be recognised in the long-term sustainability of the Queensland sugarcane industry. CANEGROWERS has been involved with industry extension in the development of a number of BMP products over the years.

Principles of Best Management Practice

Management of inputs and operations in sugarcane production should be aimed at sustainability. This means that profitable cane production needs to be achieved in combination with the maintenance of resources on-farm and with minimal off-site effects.

The basic philosophy is that there are no set 'recipes', but rather a recognition of on-farm management styles that allow for progress towards the adoption of an improved cropping system that is based on best-practice principles. Importantly, the concept of best management practice recognises that the sugarcane production system is constantly evolving.

Best-management practice should therefore be considered across the entire farming system and cover the following key considerations:

- Soil management
- Crop and harvest management
- Water management
- Pests, disease and weed management
- Workplace health, safety and skills management
- Landscape and biodiversity management
- Business management

A selection of BMP and management products for the Queensland sugarcane industry are outlined and can be found on CANEGROWERS and BSES websites:

- SmartCane Riparian and Wetland Areas on Cane Farms
- SmartCane Principles of Farm Business Management
- SmartCane Harvesting and Ratoon Management
- SmartCane Plant Cane Establishment and Management
- SmartCane Principles of Best Management Practice
- SmartCane Fallow and Land Management
- Code of Practice for Sustainable Cane Growing in Queensland
- ChemCert chemical training
- CANEGROWERS Farm Chemical Record Book
- Virtual Bus Tour DVD – Good Farm Practice
- Virtual Bus Tour DVD - Nutrient Management
- Virtual Bus Tour DVD – Water Management
- BSES Farm Productivity Assessments (FPA)
- BSES Compass Program
- BSES Weed Management Plans
- BSES Integrated Weed Management courses

Water quality improvement programs

CANEGROWERS is currently involved in a number of programs designed to improve water quality for the Great Barrier Reef including Reef Plan, Reef Regulations and Reef Rescue. These are outlined in the subsequent sections below.

Reef Plan

The Reef Water Quality Protection Plan 2009 (Reef Plan) is a joint initiative of the Australian and Queensland Governments (Australian Government, 2003). It incorporates and supports the actions of government, industry and community groups and is implemented by various government and non-government bodies throughout the reef catchments and beyond.

The plan is a joint Australian and Queensland Government initiative that specifically focuses on non-point-source pollution. This is where irrigation or rainfall carries pollutants such as sediments, nutrients and pesticides into waterways and the reef lagoon.

Reef Plan sets ambitious but achievable targets for water quality and land management improvement, and identifies actions to improve the quality of water entering the reef. Initially established in 2003, the plan was updated in 2009. It details specific actions and deliverables to be completed by 2013 when Reef Plan will be reviewed.

The Australian and Queensland Governments are investing in excess of $375 million over five years on Reef Plan activities. This includes $200 million for the Australian Government's Caring for our Country Reef Rescue initiative and $175 million for Reef Plan activities through the Queensland Government including $50 million to implement the Reef Protection Package.

Reef Plan Goals

- To halt and reverse the decline in water quality entering the reef by 2013.
- To ensure that by 2020 the quality of water entering the reef from adjacent catchments has no detrimental impact on the health and resilience of the Great Barrier Reef.
-

Water quality targets

- By 2013, there will be a minimum 50 per cent reduction in nitrogen and phosphorus loads at the end-of-catchments.
- By 2013, there will be a minimum of 50 per cent reduction in pesticides at the end-of-catchments.
- By 2013, there will be a minimum of 50 per cent late dry season groundcover on dry tropical grazing land.
- By 2020, there will be a minimum 20 per cent reduction in sediment load at the end-of-catchments.

Land management targets

- By 2013, 80 per cent of landholders in agricultural enterprises (sugarcane, horticulture, dairy, cotton and grains) will have adopted improved soil, nutrient and chemical management practices.
- By 2013, 50 per cent of landholders in the grazing sector will have adopted improved pasture and riparian management practices.
- By 2013, there will have been no net loss or degradation of natural wetlands.
- By 2013, the condition and extent of riparian areas will have improved.

Actions

Reef Plan has identified and prioritised 11 actions critical to ensuring the success of Reef Plan. These actions are categorised as:

- Focusing the activity
- Responding to the challenge
- Measuring success.

Who's involved?
A number of committees have been established to help ensure a coordinated and cohesive approach to implementation, and appropriate commitment of resources to actions.

Reducing the impacts of land use on reef water quality is not solely the responsibility of governments. A wide range of organisations have an interest and role in improving water quality flowing to the reef.

Government

- Australian Government - Department of Sustainability, Environment, Water, Population and Communities
- Great Barrier Reef Marine Park Authority
- Queensland Government - Department of the Premier and Cabinet
- Queensland Government - Department of Environment and Resource Management
- Queensland Government - Department of Employment, Economic Development and Innovation
- Queensland Government - Department of Local Government and Planning
- Local Government Association of Queensland

Regional Natural Resource Management bodies

- Cape York Sustainable Futures (Cape York region)
- Burnett Mary Regional Group (Burnett Mary region)
- Fitzroy Basin Association (Fitzroy region)
- NQ Dry Tropics (Burdekin region)
- Reef Catchments (Mackay Whitsunday region)
- Terrain Natural Resource Management (Wet Tropics region)

Industry

- AgForce
- Canegrowers
- GrowCom
- Queensland Farmers' Federation
- Queensland Dairyfarmers' Organisation
- Fertiliser Industry Federation of Australia
- Cotton Australia

Research groups

- CSIRO
- Australian Institute of Marine Science
- The University of Queensland
- James Cook University
- Reef and Rainforest Research Centre

Environment and community groups

- Queensland Conservation Council
- WWF
- Great Barrier Reef Foundation

Reef Rescue

Reef Rescue $200 million investment over five years and a key component of Caring for our Country, the Australian Government's over $2 billion initiative to restore the health of Australia's environment and improve land management practices (Australian Government, 2008).

Reef Rescue's objective is to improve the water quality of the Great Barrier Reef lagoon by increasing the adoption of land management practices that reduce the run-off of nutrients, pesticides and sediments from agricultural land.

Reef Rescue has targets of:

- To increase by 1300 the number of farmers who have adopted land management practices that will improve the quality of water reaching the Reef lagoon by 2013.
- To increase by 650 the number of pastoralists over an area of 3.8 million hectares, who have improved ground cover monitoring and management in areas where run-off from grazing is contributing significantly to sediment loads and a decline in the quality of water reaching the Reef lagoon by 2013.

Water quality targets

- By 2013, there will be a minimum 25 per cent reduction in nitrogen and phosphorus loads at the end-of-catchments.
- By 2013, there will be a minimum of 25 per cent reduction in pesticides at the end-of-catchments.
- By 2013, there will be a minimum 10 per cent reduction in sediment load at the end-of-catchments.

Reef Rescue is made up of five integrated components:

- Water Quality Grants ($146 million over five years)
- Reef Partnerships ($12 million over five years)
- Land and Sea Country Indigenous Partnerships ($10 million over five years)
- Reef Water Quality Research and Development ($10 million over five years)
- Water Quality Monitoring and Reporting, including the publication of an annual Great Barrier Reef Water Quality Report Card ($22 million over five years)

The Water Quality Grants component provides funds to land owners and managers to implement improved land management practices to reduce the amount of nutrients, chemicals and sediments leaving their farms and impacting on Reef water quality.

The Reef Partnerships component provides assistance for extending information to, and help to build relevant skills in land owners and managers. This may include assistance for group activities, on-site risk assessments, the development of farm management systems and property plans, and industry and community wide environmental management and awareness programs.

The Water Quality Grants and Reef Partnerships components are being rolled out through collaborative action by Queensland coastal regional natural resource management bodies (NRM) and peak agricultural industry bodies (CANEGROWERS).

Under the Reef Rescue program, sugarcane has received $26,568,644 of Reef Rescue funding. This has been supported by $37,130,930 of landholder cash and $9,714,137 of in-kind bringing a total of $73,413,731 of funding to practice change in the Great Barrier Reef. For every $1 that the Federal Government puts in sugarcane growers have put in $1.76.

A total of 2477 grants have been distributed to 1670 unique farmers for individual projects since June 2008. Sugarcane has received 1400 projects since June 2008 with approximately 119,391 hectares under practice change for chemicals in the Great Barrier Reef catchments.

Further evidence of practice change in sugarcane is outlined in the Reef Rescue activities from June 2008 to December 2010:

- 1051 cane farmers have received nearly $23.7 million of incentives and invested $41.7 million of their own cash and in-kind to improve their practices over 393,000 ha.
- Cane growers have improved fertiliser practices over 126,000 ha, budgeting crop nutrition more precisely, and using state of the art technology to apply fertiliser.
- The cane industry has improved pesticide application to 61,000 ha, now calibrating spray nozzles and using the latest spraying technology. Cane farmers have invested in global positioning systems (GPS) and autosteer tractors and harvesters to minimise use of pesticides. These practices also minimise costs of machinery, labour and fuel.
- 138,000 hectares of cane land is now under crop rotation and soil management practices such as zero or minimum tillage. These practices minimise erosion, decrease water use, and improve fertility.
- These practices applied to laser levelled fields help reduce soil compaction and enable growers to reuse runoff water in irrigation systems.

CANEGROWERS has a Reef Rescue contract with the Australian Government. A selection of the recent milestones are summarised below

Communications - Magazine
The *Australian Canegrower* magazine has committed to running a Reef Rescue article in each of its 25 editions per year. CANEGROWERS has also been expanding the Reef Rescue section from one, to in many cases 3-4 pages each edition.

CANEGROWERS developed the Farmers Teaching Farmers section for the magazine, which showcased innovative growers, practice change activities and Reef Rescue projects. The respective articles explained what the grower was undertaking, how, and why they were doing so. A feature of the each article was the key learnings box – a summary of the project and its outcomes and benefits. This provides ideas, motivation and encouragement in the uptake of practices or the further refinement of an idea for the grower's specific farm and circumstances.

Water Quality: Virtual Bus Tour DVD project
The Virtual Bus Tour project looks at ways to bring the bus tour to the growers. This year 4000 sugarcane growers have received a DVD on water quality monitoring. This DVD builds on the information delivered in last year's DVD on nutrient management. The focus of next year's DVD will be good practices case studies on farms.

SmartCane website
CANEGROWERS has built a best management practice portal to house best management practice information in an easy-to-find and easy-to-understand format.

The SmartCane website portal will allow growers to easily access information on best practices and technologies. Over time it will be built up to include information on all best practices. For each best practice, the website will give the grower a list of resources, such as:

- BMP reference – the official information from the BMP Booklets
- Articles on growers using the BMP
- Video case studies on growers using the BMP

- Audio interviews of growers using the BMP
- Interesting facts and statistics of benefits gained by using that BMP
- Links to other useful resources

Education: Cowboys in the classroom
CANEGROWERS has developed a new education module for years 5-7's about science and technology on sugarcane farms with the Queensland Cowboys Rugby League Club. A video about practice change in the sugarcane industry was developed with the educational kit and distributed to those schools in Queensland. The video is supported by a paddock to plate video to give children the context of what farming means – with the projects honed in specifically on water quality. The videos are also available free the CANEGROWERS website

Farmers teaching Farmers
CANEGROWERS developed the Farmers Teaching Farmers section for the magazine, which showcased innovative growers, practice change activities and Reef Rescue projects. The respective articles explained what the grower was undertaking, how, and why they were doing so. This broadens the reach of the Farmers Teaching Farmers program, as over 75% of Australian cane growers use the Australian Canegrower magazine as their primary source of information on the industry and growing cane.

The field component included events and activities in Babinda, Mulgrave, Innisfail, Herbert River from the Wet Tropics; Proserpine, Mackay and Plane Creek from the central region; and Isis and Maryborough from the Southern region. Events included tours of successful Reef Rescue projects, inspection of equipment including hooded sprayers, irrigation equipment, fertiliser spreaders, control traffic, zonal tillage equipment, sediment traps, and irrigation systems. Growers who had not previously applied for Reef Rescue grants are now considering the program and appeared more interested in the application process and how to get funding.

GBR Wide ABCD Land Management Practice Framework
The Great Barrier Reef Wide ABCD Land Management Practice Framework (GBR Framework) for sugarcane was established to provide a consistent framework to measure practice change, water quality improvement and the success of the Reef Rescue program over time. Under the framework, practices within the sugarcane industry are categorised as an *A, B, C* or *D* class of practice as described in table 3 below.

Table 3: Description of ABCD practices for sugarcane.

Class of Practice	Description of practice
A	Cutting-edge practices that require further calibration of environmental, social and economic costs/benefits.
B	Currently promoted practices often referred to as "Best Management Practices".
C	Common practices. Often referred to as 'Code of Practice'.
D	Practices that are superseded or unacceptable by industry and community standards.

The objective is to encourage sugarcane growers to be at a *B* class of practice for their farming situation. This is commonly known as Best Management Practice or BMP.

The ideal situation is to have growers operating all practices at *B* across the entire farm in the categories of soil, nutrient, and herbicide management. Reality sees growers operating a mix of individual *B, C* and

sometimes *D* practices, depending on their farming location, seasonal conditions and particular circumstances. However, the emphasis is on continual improvement and encouraging growers to move to *B* practices.

Growers operating *A* level practices are considered as early adopters undertaking cutting edge practices. These practices are yet to be proven and therefore growers aren't actively encouraged to move to *A* without evidence of sustainability. Once proven however, these *A* practices are considered as Best Management Practices and become *B* under the framework.

The ABCD Framework groups practices into soil, nutrient, and herbicide management categories. The framework was then used to develop the baseline for the Reef Rescue program. The baseline and ABCD Framework which will be used to benchmark practice change and water quality improvement over the life of the Reef Rescue program.

Strategy for continuous improvement and communication
The GBR Wide ABCD Land Management Practices Framework will continuously evolve as technology and knowledge of practices improves. The introduction of new land management practices and the refinement of existing practices will be undertaken by industry organisations and partners through targeted research and development and practical extension.

The emphasis is on continual improvement and encouraging growers to move to Best Management Practice.

2009-10 GBR Wide Benchmarking for Sugarcane Land Management Practices
CANEGROWERS as part of its Communications and Coordination project is coordinating the benchmarking for the adoption of land management practices in for the sugar cane industry using the industry-wide ABCD framework that was developed for the baseline.

The number and percentage of cane growers and associated hectares that are undertaking ABCD practices for the management of nutrient, herbicides, soils and cane water at a regional and GBR-wide level are determined using industry, government and Reef Rescue data for the Southern, Central, Burdekin and Northern regions.

The data is provided to the Paddock to reef modellers under Reef Plan, which then produces the Reef Report Card. This process is ongoing until 2013.

- **CANEGROWERS recommends that $200 million Reef Rescue program that sits under the Reef Plan is evaluated in the APVMA's review of diuron. Both have targets to improve water quality and reduce herbicides by 25% and 50% respectively. Herbicides of interest under both programs include diuron.**

Reef Regulations

The *Great Barrier Reef Protection Amendment Act 2009* (Reef Regulations) introduced regulations to improve the quality of water entering the Great Barrier Reef (DERM, 2010). Reef Regulations apply only to sugarcane growing and cattle grazing properties in the Burdekin Dry Tropics, Wet Tropics and Mackay Whitsunday catchments in North Queensland.

According to the Queensland Government, regulation was necessary to ensure that farmers adopt management practices that reduce the levels of farm chemicals, fertiliser nutrients and sediment harming the Reef.

The new legislation is part of the Queensland and Australian Governments' Reef Plan and Reef Rescue initiatives.

A comprehensive list of products is provided on the Queensland Governments Reefwise farming website www.reefwisefarming.qld.gov.au CANEGROWERS have highlighted several regulations below and products relating to chemicals (diuron) for the sugarcane industry. These are attached.

- Sugarcane Growing Environmental Risk Management Plan (ERMP)
- Chemical Environmental Risk Management Plan (Chemical ERMP)
- New Mandatory chemical requirements – sugarcane growing
- Principles to guide the preparation of weed management plans
- Rainfall run-off risk assessment
- Sugarcane Grower's Guide to Chemical Use under the Reef Protection Legislation
- Reef Protection Herbicide List – Sugarcane Record Keeping
- Training for the use of certain agricultural chemicals

Chemical Regulations

Since 1 January 2010, cattle graziers on properties of more than 2000 ha, and all commercial sugarcane growers in the Wet Tropics, Burdekin Dry Tropics and Mackay Whitsunday catchments, are required to meet mandatory requirements for record keeping and the use and preparation of the herbicides: atrazine, ametryn, hexazinone, diuron and tebuthiuron.

Mandatory requirements on the use of these chemicals have been introduced under the Chemical Usage (Agricultural and Veterinary) Control Regulation 1999. These requirements, in relation to herbicides, must be observed in addition to the existing label instructions. The Queensland Government document titles "New Mandatory chemical requirements – sugarcane growing" outlines all control of use changes.

Since 1 July 2010, regulated sugarcane growers have been required to hold recognised training qualifications in chemical handling, preparation, application, transport, storage, and weed control. The chemical use training fact sheet provides further information.

Since 1 October 2010 all sugarcane growers in all three catchments are required to observe new mandatory requirements when using certain herbicides, including:

When using herbicides that contain ametryn, **diuron** or hexazinone within 20 m of a down-slope water body:

- do not apply within 20 m of all down-slope water bodies
  OR
- at the time of spraying, have a 5 m effective vegetated treatment area (EVTA) between the edge of the down-slope water body and any point where low flow run-off exits the inter-row furrows.

If a grower cannot comply with any of the mandatory requirements, they can propose an alternative approach an accredited Chemical ERMP.

Runoff risk assessment

The Chemical Usage (Agricultural and Veterinary) Control Regulation 1999 has placed restrictions on the use of prescribed agricultural chemicals on commercial sugarcane properties in the Wet Tropics, Burdekin Dry Tropics and Mackay Whitsunday catchments.

Before using herbicides containing ametryn, diuron or hexazinone, you must take account of weather conditions to decrease the risk of these chemicals leaving your farm in rainfall run-off.
Questions 1 and 2 must be completed before using herbicides containing ametryn, **diuron** or hexazinone.

1. At any time before the product is used, does the current weather forecast indicate 'moderate-to-heavy' rain for the area of application for the 48 hours after the application time?

Yes — do not spray
No — go to question 2

2. Within two hours before spraying, check the Bureau of Meteorology (BoM) radar. Does the radar show moderate-to-heavy rain within 50 km of the application site and moving towards the application site?

Yes — do not spray
No — you can spray

Environmental Risk Management Plans (ERMP)

An Environmental Risk Management Plan—commonly referred to as an ERMP—is a property management plan to minimise the risk of sediment, herbicide and nutrient run-off affecting the health of the Great Barrier Reef, while keeping the land in optimum productive condition.

Properties that use more than 70 ha to grow sugarcane in the Wet Tropics catchment need to submit an ERMP to the Department of Environment and Resource Management by 30 September 2010.

An ERMP will help sugarcane growers and cattle graziers reduce their risks to reef water quality by:

- identifying potential risks and hazards – situations or geographical features that, if poorly managed, could threaten water quality
- describing current practices used to manage adverse effects on water quality
- developing reasonable and practical actions to improve these practices where necessary
- setting targets to measure and monitor progress.

Once an ERMP is submitted it will be assessed by the department within 60 business days. If the plan meets the criteria it will be accredited for a stated term. If the plan does not meet the criteria, a reef protection officer will make contact to discuss a way forward.

Providing detailed information that best describes your land management system may enable a longer accreditation term to be granted, and will also reduce the need for the department to request further information at a later date.

<u>ERMP assessment and accreditation</u>

Once an ERMP is submitted, it will be assessed by the department within 60 business days. Reef Protection Officers use a set of accreditation principles and criteria to guide their decision making.
During assessment, an officer may request further information to clarify any elements of the ERMP. If the ERMP meets the criteria, it will be accredited for a stated term.

A Landholders Guide on ERMP accreditation outlines the criteria used to assess ERMPs and the standards required for a one, three or five-year accreditation term.

Accreditation involves the assessment of: the information in an ERMP; any geographical information specific to the property; how the current and proposed mix of practice, farm or property design and infrastructure are or will be managed to minimise risk to reef water quality; and, the accreditation term. DERM cannot change an ERMP without consent and will take steps to clarify certain things or to suggest changes or alternative actions. Once the ERMP is accredited, requests can be made at any time to amend it, for example to reflect a change in circumstances or management approach.

Annual reporting

An ERMP will have a number of performance targets. An annual report must be provided to the department outlining the previous year's progress towards achieving the ERMP targets. An approved form and guidelines for annual reporting are currently in the design and development stage.

Record keeping

To understand the effectiveness of management practices in minimising the amount of chemicals, fertiliser and sediment being lost from the farm and transported to the reef, accurate records are needed.

All commercial sugarcane growers and all graziers grazing cattle on more than 2000 hectares in the Burdekin Dry Tropics, Mackay Whitsunday or Wet Tropics catchments must keep records from 1 January 2010.

Records should be kept on the property and produced if requested by an officer of the Department of Environment and Resource Management. If there is an established record keeping system on the property, it can continue to be used if it records all the information required under the regulation.

- **CANEGROWERS recommends that the Queensland State Government's Reef Regulations that targeted residual PSII herbicides, particularly diuron, is evaluated in the APVMA's review of diuron.**

Research & Development under Reef Rescue and Reef Regulations

There is a significant body of R&D either being undertaken or proposed over the next few years in the catchments of the Great Barrier Reef. This research will contribute to the further understanding and influence of processes and practices on farm, within catchments and in the reef lagoon that affect water quality.

Successful Reef Rescue R&D projects and project leaders are outlined below. RRR037, RRR038 and RRR058 are looking specifically at chemicals.

Project ID	Project Title	Project Leader & Organisation
Socio-Economic Subprogram		
RRRD039	Integrated assessment of BMP cost-effectiveness and decision tool for regions and landholders	Stuart Whitten CSIRO
RRRD010	Factors affecting adoption of land management practices that have water quality benefits in the GBR catchments: Evaluation scenarios for Cane Farming	Delwar Akbar University Central Queensland
RRRD011	Capturing historic small catchment study (paddock scale) data to support quantification of management impacts on water quality on the Great Barrier Reef	David Freebairn RPS Australia East
Grazing Practices Subprogram		
RRRD024	Quantifying the impacts of rehabilitating degraded lands on soil health, pastures, runoff, erosion, nutrient and sediment movement	Gavin Peck DEEDI
RRRD027	Getting ground cover right – thresholds and baselines for a healthier reef	Robert Karfs DEEDI
RRRD032	Improving grazing management practices to enhance ground cover and reduce sediment loads	Scott Wilkinson CSIRO
RRRD009	Runoff Nitrogen generation rates from pasture legumes – an enhancement to reef catchment modelling	Bruce Cowie DERM
Sugar Practices Subprogram		
RRRD056	Evaluating and improving A-Class practices to control nutrient losses from sugarcane	Peter Thorburn CSIRO
RRRD004	Advanced drip and optimised furrow irrigation to minimise sediment, nutrient and pesticide losses to the environment through deep drainage and runoff from sugarcane and banana industries of wet tropics in	David Midmore University Central Queensland

	northern Queensland	
RRRD020	Mineralisation of nitrogen within the sugarcane cropping system following legume fallows and its effect on water quality	Bernard Schroeder BSES Limited
Horticulture Practices Subprogram		
RRRD049	Minimising off-farm movement of nitrogen and phosphorus in the north Queensland banana industry	John Reghenzani Terrain NRM
RRRD054	Development of a banana modelling capability to enhance reporting of Reef Rescue outcomes	Tony Webster CSIRO
Dairy Practices Subprogram		
RRRD055	Validating the cost/benefits of improved fertiliser practices and quantifying nutrient loads and pathways from irrigated dairy pastures in the Wet Tropics and the Burnett-Mary regions	Ruth McInnes Queensland Dairyfarmers' Organisation
Chemicals (Herbicides and Pesticides) Subprogram		
RRRD037	Pesticide dynamics in the Great Barrier Reef catchment and lagoon: management practices in the sugarcane industry	Jon Brodie James Cook University
RRRD038	Pesticide dynamics in the Great Barrier Reef catchment and lagoon: management practices (grazing, bananas and grain crops) and risk assessments	Jon Brodie James Cook University
RRRD058	A novel biological method of monitoring herbicides	Ben Kefford Uni of Technology Sydney (UTS)
Improved Water Quality and Landscape Condition Monitoring Techniques		
RRRD030	Pollutant load estimation for Great Barrier Reef (GBR) catchments: Accounting for the uncertainty in monitoring and modelled data using data assimilation techniques	Petra Kuhnert CSIRO
RRRD016	Developing integrated assessment metrics for reporting of water quality in the Great Barrier Reef lagoon	Vittorio Brando CSIRO

Below are the proposals that have been received by DERM for funding under the Reef Protection Program (Reef Regulations) science program. These proposals have not been approved and are currently under consideration.

ID	Title	Lead
1B. Program prioritisation		
Sub04	Assessment of the risk of pollutants to the ecosystems of the GBR including differential risk between sediments, nutrients and pesticides and between land uses, industries and catchments	Brodie ACTFR-JCU, CSIRO
Sub02	Cost-effective management actions to achieve Great Barrier Reef water quality guidelines: a spatial environmental–economic approach	Kroon CSIRO
Sub25	Establishing reef regional sediment, nutrient and pesticide water quality targets	Waters DERM, ACTRF-JCU
Sub03	Synthesizing historical land use change data, fertiliser and pesticide usage data and pollutant load data in the regulated catchments to quantify baseline and changing pollutant loads exported to the Great Barrier Reef	Lewis ACTFR-JCU
1C. Pollutant fate		
Sub24	Groundwater delivery of nutrients and PSII-active herbicides to the Reef and the potential for mitigation: a review of current knowledge	Hunter consultant
Sub30	Prevalence of PSII pesticide and nutrients in groundwater and their transport to rivers from sugar cane cropping in the lower Burdekin	Vardy DERM
Sub44	Collecting baseline data to enable groundwater modelling of pesticide transport in the Burdekin and Wet Tropics	Silburn & Carroll DERM-P2R
Sub05	Trapping suspended sediments, particulate and dissolved nutrients and pesticide residues in off-farm vegetated systems in the Great Barrier Reef catchment area.	Brodie ACTFR-JCU
2D. Cane systems and loads		
Sub33	Benchmarking use of nutrients and pesticides in cane farming	INTERNAL
Sub32	Implementing and Demonstrating an Adaptive Management Approach to Improve Water Quality at a Sub-Catchment Scale in the Burdekin Sugarcane Area	McShane BBIFMAC
Sub42	Identification and analysis of ABCD cane management practice adoption and input details within the Mackay Whitsunday region with a focus on key WQIP sub-catchments with a high percentage of cane land use	Higham Reef Catchments,
2E. Cane nutrients		
Sub07	Assessing ecosystem response to runoff water quality using an algal bioassay	Ivastinovic ERS-DERM
Sub23	Enhancing Reef Protection decision support tools through links with P2R paddock scale modelling	Thorburn CSIRO
Sub08	Managing the nitrogen cycle to maximise nitrogen use efficiency from legumes for profitability and water quality outcomes	Wang ERS-DERM
Sub39	Next generation change – Practical elimination of nitrogen loss from cane using endogenous atmospheric nitrogen fixation	Terrain NRM
Sub38	Managing the nitrogen cycle to maximise nitrogen use efficiency for profitability and water quality outcomes	Moody ERS-DERM

ID	Title	Lead
Sub41	"Biochar" – Utilising trash for Improved Nitrogen Management	McShane BBIFMAC
Sub35	Optimisation of variable rate nitrogen application where average yield potential zones are low due to poor subsurface drainage and associated landscape position	Markley DEEDI
Sub22	Better definition of the benefits of precision practices to cane farming and Reef protection	Thorburn CSIRO
Sub37	Develop and implement cane precision agriculture training program	Sing, DEEDI
3F. Cane weeds & pesticides		
Sub36	Strategic control of weeds of cane production found off-farm in catchments of the Wet Tropics	Dryden Terrain NRM
Sub19	The role of PSII and non-PSII herbicides in the Queensland sugar industry; current expectations, trends, opportunities and limitations	Davis ACTFR-JCU
Sub40	Risk management tools for herbicide contamination: rapid field tests and interactive industry engagement	Reghenzani Terrain NRM
Sub27	Maximising Paddock to Reef pesticide management effectiveness by monitoring for alternate (non-regulated) pesticide use	Warne DERM
Sub16a	ReefWise weed management in the cane industry: Identifying factors that influence PSII herbicide use and opportunity to reduce use – Stage 1	Emtage Terrain NRM
Sub16b	ReefWise weed management in the cane industry: Identifying factors that influence PSII herbicide use and opportunity to reduce use – Stage 2	Smith UQ
Sub34	Achieving regional Integrated Weed Management in cane lands—effective area-wide weed management	INTERNAL
3G. Cane socioeconomics		
Sub31	Cane economics to inform and achieve improved water quality outcomes	Poggio DEEDI
Sub06	How will RPP policies and regulation be affected by changes in the cane and grazing industries?	Durante SSI-DERM
Sub17	Landholder motivational profiles and their implications for achieving management practice change and water quality outcomes for the RPP program	Durante SSI-DERM
Sub18	Evaluating the Reef Science Program: how science-based is current practice?	Durante SSI-DERM
Sub43	Socio-economic research, analysis and intervention foundations for Great Barrier Reef Protection Information Flows	Eagle/Case JCU
4H. Cane mapping & extension tools		
Sub09	Mapping environmental characteristics important for GBR water quality - identifying areas vulnerable to *groundwater* contamination	Brough ERS-DERM
Sub28	Mapping environmental characteristics important for GBR water quality - identifying areas vulnerable to *surface water* contamination	Brough ERS-DERM
Sub29	SafeGauge for Nutrients and SafeGauge for Pesticides (web–enabled)	DERM, Moody, NCEA, BSES

Conclusion

CANEGROWERS considers that the use of diuron at rates less than 1.8kg ac/ha can be shown to be efficacious, safe for the environment and facilitate the continuation of management practices that benefit soils, rivers and reef. Its availability should be continued.

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Appendices

Appendix 1 – “Independent review of APVMA’s Diuron review report for immediate action volumes 1 and 2 the reconsideration of the active constituent diuron, the registration of products containing diuron and approvals of associated labels”

Appendix 2 - CANEGROWERS diuron questionnaire