

# Foreword

*Dear Fellow Cane Grower*

*The Queensland sugar industry produces over 95% of Australia's raw sugar and is recognised as a world leader in innovation, product quality, efficiency and sustainable production.*

*Most of Queensland's 6500 sugar cane farms are owned and operated by family partnerships. The viability of your family enterprise is dependent on the sustainable use of soil and water resources. And the quality of life enjoyed by your family now, and in the future, is dependent on the protection of natural systems including land and water ecosystems.*

*In 1995 CANEGROWERS commissioned an extensive and independent environmental audit. The audit was undertaken to determine how current cane growing practices are impacting on the environment; to evaluate the adoption of more sustainable farming practices; and to identify attitudes and concerns in the broader community. The auditors worked for over a year before handing down their report in September 1996.*

*A year later CANEGROWERS Council endorsed an Environment Management Strategy which will become an integral part of CANEGROWERS five year plan. This strategy has been developed to ensure every audit recommendation is addressed in a timely and effective way.*

*The environmental audit considered that farmers need more information on best practice farming techniques. In response to this recommendation, but also to ensure you, as a cane grower, have a legal defence under the Environmental Protection Act 1994, CANEGROWERS has developed this Code of Practice for Sustainable Cane Growing over a period of two years with input from individual cane growers and officers of the Department of Environment and Bureau of Sugar Experiment Stations. The booklet provides clear advice and instructions on the procedures that should be followed and the pitfalls that should be avoided in order to minimise the risk of harm to the environment when growing sugarcane.*

*CANEGROWERS recognises that today's best practice is unlikely to be tomorrow's. In order to stay leaders in the adoption of sustainable cane farming practices we support ongoing relevant research and development.*

*The Cooperative Research Centre for Sustainable Sugar Production (CRC Sugar), based at James Cook University in Townsville, has a group which meets specifically to establish what current research can be incorporated into practical guidelines for cane growing.*

*Recognising the need for practical guidelines for riparian management based on good science but also demonstrated usefulness, CANEGROWERS has made an application to the Natural Heritage Trust for funding for a “One Million Trees for Cane Catchments” project. If funded, this project will facilitate the development of industry and region specific guidelines for riparian management that would eventually be incorporated into this Code of Practice for Sustainable Cane Growing.*

*However, in the first instance, practical information on riparian management will be incorporated into local Cane Production Board guidelines. Local Cane Production Boards, with input from Department of Environment officers, will be developing district specific guidelines for the development of new lands. The new Sugar Industry Act will, for the first time, include provision for sugarcane assignment to be cancelled if conditions of grant, including environmental constraints, are not met.*

*Sugarcane is grown in Queensland over 2100 km of coastline and across 22 catchments. Differences in topography and climate mean that some environmental issues will always be district specific and differences, for example, in farm topography, water availability and a grower’s financial situation will influence the choice of the on-farm solution to the particular problem. Nevertheless, I strongly advise you, as a grower, to follow the recommendations contained in this document unless you can discharge your “duty of care” under the Environmental Protection Act 1994 in other practicable ways.*



Harry Bonanno  
CHAIRMAN

# Introduction

The *Environmental Protection Act 1994* affects all Queenslanders. It establishes a “general environmental duty” for everyone. The main objective of the *Environmental Protection Act* is to achieve “ecologically sustainable development”, that is “the protection of Queensland’s environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends”.

The *Environmental Protection Act* aims to ensure that the things we do today will preserve or improve the health, biological diversity and productivity of the environment for the benefit of our children and grandchildren.



## What does the Environmental Protection Act mean to me?

In a nutshell, the *Environmental Protection Act* means that when you carry out any activity associated with cane farming, you need to take all reasonable and practicable measures to minimise the risk of harm to the environment.

This code gives practical advice about practices that will minimise the risk of harm to the environment while growing sugarcane.

It has been developed by CANEGROWERS with the involvement of individual cane growers, the Department of Environment (DoE), the Bureau of Sugar Experiment Stations (BSES), and the Cooperative Research Centre for Sustainable Sugar Production (CRC Sugar). The code aims to explain in cane growing terms what are “reasonable and practicable measures for minimising the risk of harm to the environment”.

This code is more than just a list of desirable farming practices. Following this code of practice is a means by which cane growers can comply with their general environmental duty under the *Environmental Protection Act 1994*. Growers who have followed this code will have

## What is sustainable development?

Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs.

improved prospects of successfully defending any legal actions brought against them in relation to environmental harm.

It is strongly recommended that you follow the advice contained in this document unless you can discharge your “duty of care” under the *Environmental Protection Act* in other practicable ways.

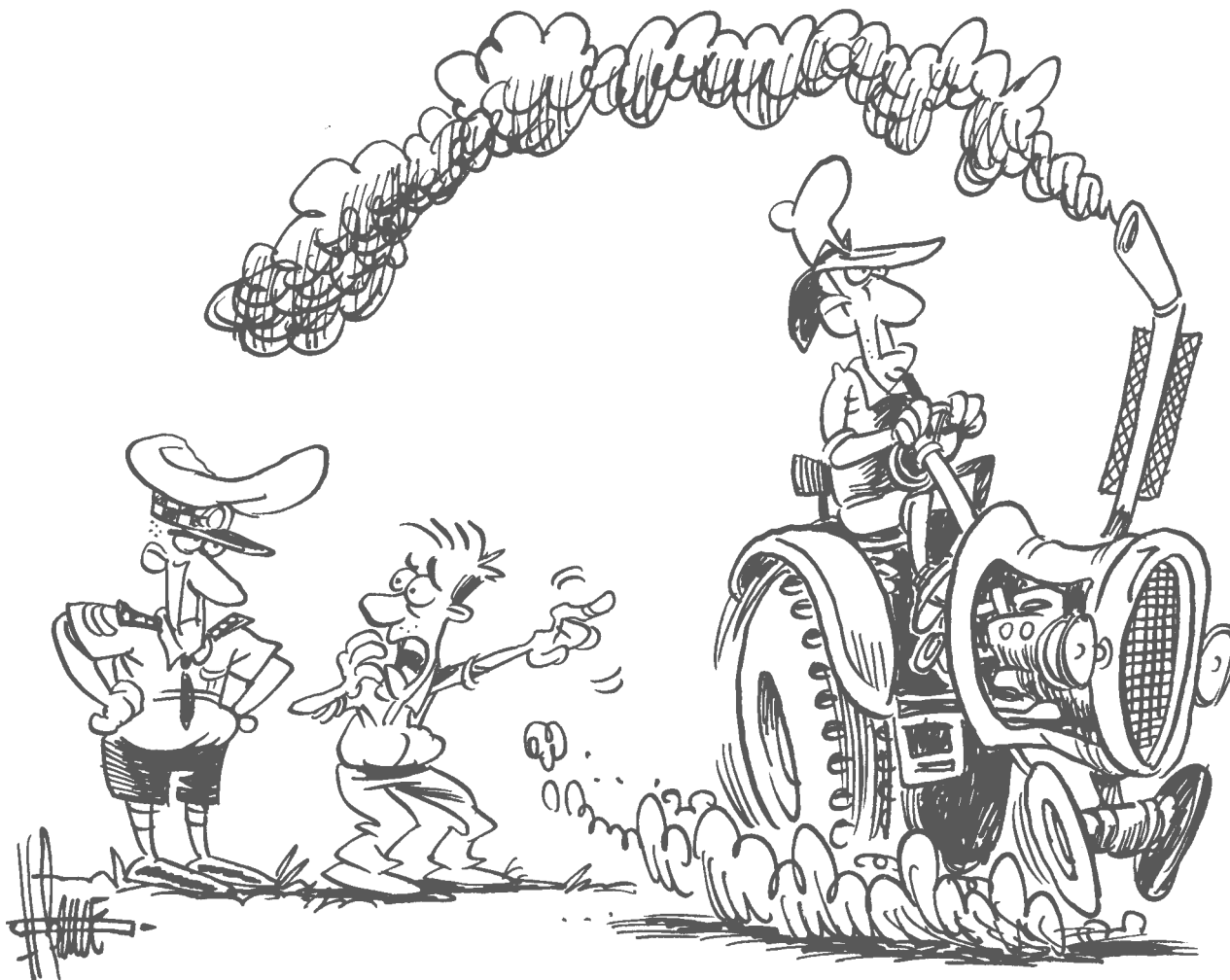
This code will be reviewed when necessary to incorporate new technologies and improvements to farming techniques.

**Does this code apply under all conditions?**

This code refers to farm management under normal climatic and seasonal conditions. It does not cover management practices under extreme weather conditions such as cyclones, flooding, severe storms, droughts or fires.



*Caring for the environment will make your farm a nicer place in which to live and work.*



*Adherence to this code of practice will assist you to defend yourself if any legal action is brought against you in relation to causing environmental harm.*

# 1. Developing New Land

Information in this section applies to land that is being developed for new cane production, regardless of whether that land was originally cleared for other farming purposes.

Before developing new land, seek advice specific to your district from your local Cane Production Board and other relevant agencies such as the Department of Natural Resources (DNR), Department of Primary Industries (DPI), Department of Environment (DoE) and Bureau of Sugar Experiment Stations (BSES).

After 1 July 1999 any application for a Cane Production Area (an area of land approved for growing sugarcane) will be subject to, and conditional upon, local Cane Production Board guidelines.



*Before you start developing new land, seek advice on its suitability for cane production.*



*Consider leaving some uncleared areas on your farm as wildlife corridors and constructing artificial wetlands for fish and bird life habitat.*

## 1.1 Before you begin

Before you start developing new land for cane growing, seek advice from DNR as to the suitability of your land for cane production. Soil suitability studies have been undertaken in most cane growing areas.

DNR's classification system takes into account:

- soil type;
- water holding capacity;
- salinity or sodicity hazard;
- stoniness; and
- erosion potential.

Other factors which affect the suitability of land for cane production include:

- environmental impacts and costs of levelling and drainage works;
- capital costs of irrigation infrastructure;
- risk of frost and drought; and
- distance to haul cane to the nearest siding.

## 1.2 Farm plans

When you apply for a new Cane Production Area or an expansion of existing cane area, supply a Farm Plan with the application.

Assistance with farm planning may be provided by your local offices of CANEGROWERS, BSES, DNR and DPI, or an accredited consultant.

A Farm Plan is a management tool. Your Farm Plan is a “living document” and you should aim to update it regularly as new information becomes available or your plans change.

Ideally the Farm Plan should be at a scale of 1:5000. Certainly the scale should be no greater than 1:10 000, depending on the available mapping information.

Your Farm Plan can include details such as:

- property **boundaries**;
- **soil information** at the most detailed available scale, but not greater than 1:25 000 should be used in drawing up Farm Plans;
- **topography** (contour of the land);
- **cane blocks** including row direction, cane variety, crop class (plant or ratoon);
- **natural watercourses** such as creeks, water flow paths, lagoons, wetlands;



*Consider strategic revegetation of previously cleared sensitive areas such as creek banks.*



*The information in your Farm Plan can be invaluable to you in managing your farm.*

- existing **vegetation**;
- proposed **revegetation sites** where appropriate;
- location of **roads and headlands**, both existing and proposed;
- **water control structures** such as contour banks, pipes and culverts;
- location of **drains** (existing and proposed) including bed width, depth and batter;
- location of silt traps, tailwater storages, lagoons or other **water retention areas**;
- type and design of most appropriate on-farm **irrigation systems**.

Local guidelines may request information on fertiliser rates as part of the farm plan. However, fertiliser rates should vary from year to year depending on soil test results.

## 1.3 Stream bank and remnant vegetation

Before you clear any land, consider leaving some areas uncleared as wildlife corridors. These corridors will encourage a greater range of native animals, birds and plants on your farm and enable wildlife to move about and recolonise. Wildlife corridors can also make your farm a more pleasant place for you and your family to live. CANEGROWERS Environment Management Strategy promotes the foster-

### **What is biodiversity?**

Biodiversity is the variety of all life forms - the different plants, animals and micro-organisms and the ecosystems of which they form a part. Cane growers can foster biodiversity in various ways. For example, green harvesting and trash blanketing increases micro-organism activity in the soil. These micro-organisms play an important role in recycling soil nutrients. Artificial lagoons create essential habitats for fish breeding and water birds. Trees and shrubs along creeks or headlands can provide nesting sites for birds.

ing of biodiversity on cane farms.

The distance between stream banks and land cleared for cultivation should be sufficient to protect trees on the stream bank, allow regeneration of stream bank vegetation and reduce the risk of stream bank erosion. The actual distance depends upon the specific circumstances of each site.

Guidelines for the management of stream bank vegetation will be developed by CANEGROWERS for the diversity of conditions supporting cane production in Queensland as part of the “One Million Trees for Cane Catchments Project”.

Do not stack and burn pushed trees near stream bank vegetation; the heat will kill trees which are not fire tolerant.

### **Why protect stream bank vegetation?**

Stream bank vegetation improves the in-stream habitat for fish and aquatic life. If of an appropriate width, and planted with appropriate tree species, stream bank vegetation can also stabilise creek banks and help reduce erosion or bank slumping. Stream bank vegetation in some situations can act as a buffer that filters farm run-off, both through ground water and surface water. Shading of streams by trees lowers the water temperature which reduces the risk of algal outbreaks and shades out exotic weeds.

Consider strategic revegetation in sensitive areas where the land has been previously cleared, particularly along stream banks.

The removal or destruction of vegetation within a watercourse without a permit constitutes a breach of the *Water Resources Act 1989*. Contact the Department of Natural Resources and/or Department of Primary Industries Fisheries Group to obtain a permit if it is necessary to do any works in a watercourse.

### **What is a watercourse?**

A watercourse includes beds, banks and any other part of a river, creek or stream which confines or contains water. This includes all elements of the watercourse up to the top of the high banks which confine flood flows within a defined channel. It may include terraces in the stream, but not the adjacent floodplains.

## **1.4 Drainage**

Good drainage is an important requirement for successful cane growing. Design drainage systems such that they do not significantly alter the nature of healthy streams, affect water quality or expose potential acid sulfate soils.

CANEGROWERS is currently developing best practice guidelines for drainage works in collaboration with the Department of Primary Industries Fisheries Group and the Department of Natural Resources. Once these guidelines are in place the permit system may be streamlined.

In the meantime:

Any work undertaken in a watercourse, including straightening or damming requires approval from the Department of Natural Resources under the *Water Resources Act 1989*.

Work undertaken in tidal creeks or waterways, and the blocking of freshwater as well as tidal waterways, requires a permit under the *Fisheries Act 1994*.



**Good drainage is important but take care not to alter the nature of healthy streams, affect water quality or expose potential acid sulfate soils.**

### 1.4.1. Wetlands

Wetlands are important for fish breeding and the maintenance of biodiversity in the aquatic environment.

On-farm drainage works must not drain water from adjacent designated wetlands.

Developments in, or adjacent to, wetlands are



**Some low lying areas may not be economically viable for cane growing.**

considered to be designated developments under the *Local Government (Planning and Environment) Regulation 1991*, and may require an Environmental Impact Statement.

Contact your Local Government or the Department of Environment for information on Environmental Impact Statements.

#### **What is a wetland?**

A wetland is the land area alongside fresh and salt waters that is flooded all or some of the time. Marine and estuarine wetlands include tidal basins, salt marshes and mangroves. Inland wetlands include marshes, ponds, lakes, billabongs and swamps. A large range of birds, fish, frogs and other organisms live in or depend on wetlands. Designated wetlands are those recognised by a national or international convention or a state law.



**Wetlands are vital for fish breeding and maintaining a diverse marine environment.**

### 1.4.2 Artificial wetlands as silt traps and nutrient sinks

If surface and ground waters are removed too quickly from cane farms, plants and micro-organisms may not have time to extract the

nutrients from fertilisers suspended in the water. These nutrients may end up in rivers and lagoons where they could cause environmental harm.

There may be low-lying areas of your farm which are not economically viable for cane growing.

As a cane grower you may be able to benefit from constructing artificial wetlands in those areas.

Artificial wetlands can be beneficial by:

- providing valuable sources of water during dry periods;
- acting as silt traps and nutrient sinks by reducing the movement of nutrients and soil off your farm;
- helping to recharge underground water aquifers; and
- serving as a breeding habitat for fish, birds and water plants.

The Department of Primary Industries Fisheries Group encourages the maintenance of drainage

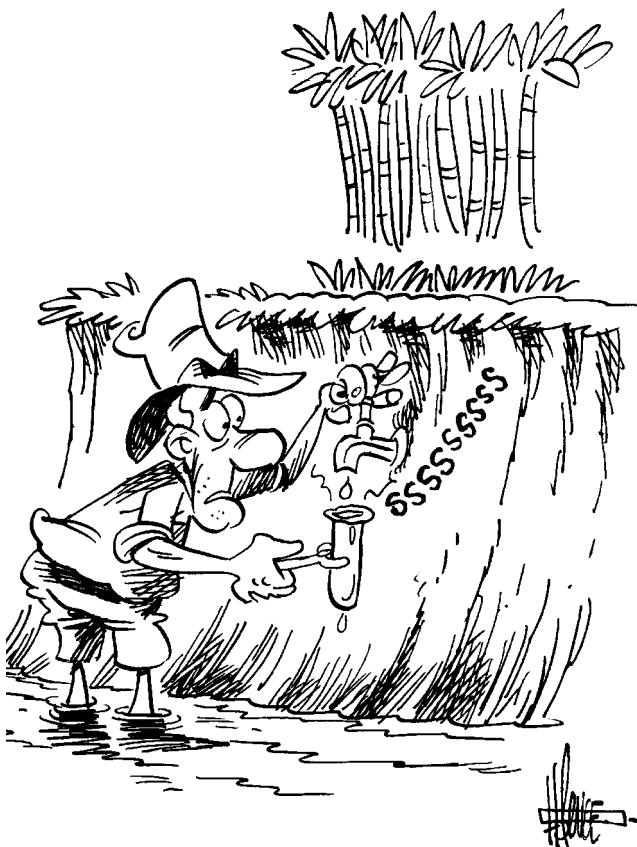
lines between artificial wetlands and other areas, including designated wetlands, to allow the passage of fish.

### 1.4.3 Acid sulfate soils and potential acid sulfate soils

Acid sulfate soils and potential acid sulfate soils do not occur in all cane growing areas but where they do, special management is necessary.

#### What are potential acid sulfate soils?

Acid sulfate soils are the common name given to soils containing iron sulfides. In Australia, the acid sulfate soils of most concern are those which formed within the past 10 000 years, after the last major sea level rise. When the sea level rose and inundated land, sulfate in the sea water mixed with land sediments containing iron oxides and organic matter. The resulting chemical reaction produced large quantities of iron sulfides in the waterlogged sediments. When exposed to air, these sulfides oxidise to produce sulfuric acid, hence the name acid sulfate soils.



*Acid sulfate soils require special management.*

If you cultivate soils with a potential acid sulfate soil layer between 0.4 m and one metre of the surface, you can minimise the potentially negative impact on adjacent areas by ensuring that:

- the depth of potential acid sulfate soil layers is determined;
- cultivation does not penetrate the potential acid sulfate soil layer or bring it to the surface;
- drains do not penetrate the potential acid-sulfate soil layer unless the water table is maintained;
- natural water tables are not artificially lowered into the acid sulfate soil layer as this may result in the oxidisation of the potential acid sulfate soil layer;
- water storages should be designed appropriately;
- where potential acid sulfate soil layers are disturbed, bury them below the water table level.

If any of the potential acid sulfate soil layer is

disturbed and oxidation of the potential acid sulfate soil occurs, you should try to minimise the negative impacts on adjacent systems.

Appropriate action may include:

- installing drainage schemes which do not further disturb the acid sulfate soil layer;
- increasing pH of leachate within 48 hours of disturbance by liming of drain edges and drain spoil;
- liming of soils to increase pH; and

- visual and pH monitoring of run-off from the drainage system after installation.

Controlled tidal flood gate management may be appropriate in established cane growing areas which contain potential acid sulfate soils.

The distribution of potential acid sulfate soils in Queensland is currently being determined by the DNR. Contact your local DNR office to determine whether maps are available for your area.

## 2. Established Farms

### 2.1 Farm Plans

Some time in the future you may find yourself in the unenviable position of having to defend yourself against a claim that one of your farming activities has caused harm to the environment.

Hopefully this won't happen but if it does, evidence of good planning will assist in your legal defence. A written Farm Plan is a good way for you to demonstrate that you are managing technology in an environmentally friendly way.

CANEGROWERS will try to ensure that cane growers receive appropriate support in the development of Farm Plans from those organisations that provide the industry with research and extension services. However, you must accept the principal responsibility yourself of ensuring that your farming operations represent best practice and that they are properly documented.



***Good planning and record keeping will be invaluable if you ever have to defend your farming practices.***

You may need to have a Farm Plan if you operate an established cane farm and intend to apply for an increase in water allocation of more than 10% within an area controlled by the Department of Natural Resources.

For more details on Farm Plans refer to the section under the heading Developing New Land (Section 1.2).

## 2.2 Vegetation management

Consider how native vegetation could be a part of your farm and how this vegetation could link with other areas of native vegetation in your catchment.

Play an active role in the development and implementation of catchment strategies developed by local Landcare groups or Integrated Catchment Management Committees.

Consider replanting sensitive areas on your farm, particularly stream banks. Stream bank vegetation enhances wildlife corridors and improves instream habitat for fish and aquatic life. Stream bank vegetation also can help stabilise creek banks and prevent erosion or bank slumping.

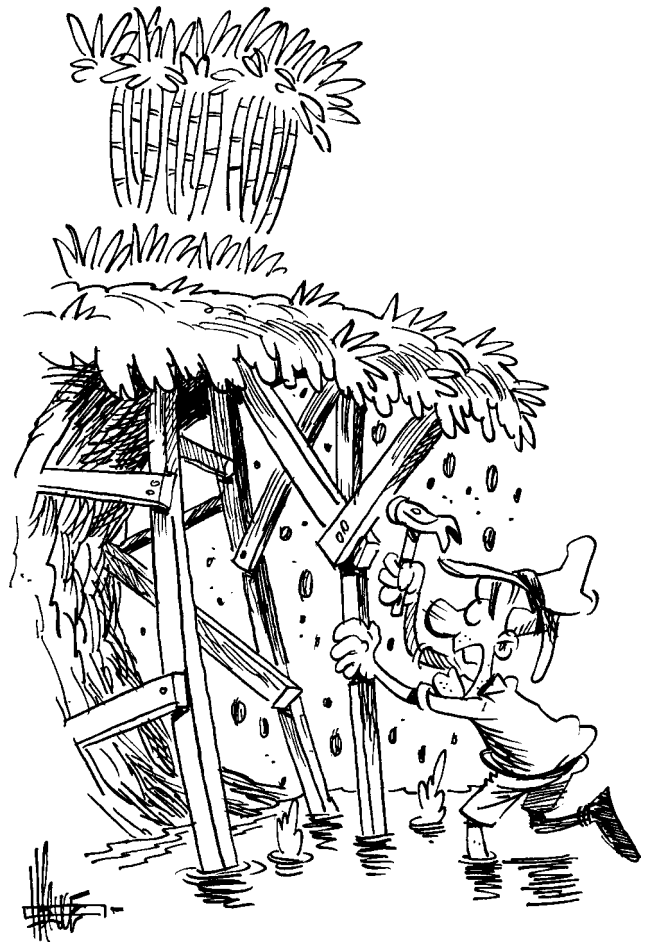
Growers who develop vegetation management plans as part of their Farm Plan may be exempt from Local Government vegetation planning schemes. In some shires, land planted to trees attracts rate rebates.

Revegetation also may be assessed as a farm improvement for income tax purposes, with associated tax relief.

Some River Trusts will subsidise tree planting. A variety of other tree planting schemes exist in different regions. CANEGROWERS, through the “One Million Trees for Cane Catchments” project, hopes to facilitate the supply and planting of appropriate trees on cane farms and in cane growing communities.

### Are you using best practice soil management techniques?

- ✓ Soil conservation measures in place
- ✓ Green Cane Trash Blanketing where appropriate
- ✓ Fallow land maintained under cover crops or trash cover where possible
- ✓ Cultivations minimised



*Stream bank vegetation can help stabilise creeks and prevent erosion and bank slumping.*

Advice on appropriate tree species will be available to growers who want to be a part of the project.

## 2.3 Soil management

Conserve and maintain the structure, fertility and biological characteristics of your soil using one or a combination of the following techniques.

### 2.3.1 Reducing erosion

Where practicable, use minimum tillage planting systems to reduce the potential for soil erosion.

For example:

- adopt spray-out fallow or retain fallow land under a cover crop;
- avoid cultivating land to a fine tilth; and
- minimise the number of cultivations in preparation of the plant crop and the maintenance of ratoon crops.



**Where practicable, use minimum tillage systems to reduce potential for erosion.**

Where there is potential for erosion, adopt a modified contour system in which rows are planted approximately on the contour, coupled with the use of contour banks and water ways.

Practise early fill-in of plant cane to allow soil to consolidate and reduce erosion.

To minimise erosion and improve soil health, adopt green cane harvesting and trash blanketing in those areas where this method is compatible with profitable cane growing.

### **2.3.2. Fertilisers and soil ameliorants**

Fourteen essential nutrients are required to produce healthy cane. Nutrients that are absent or low in concentrations need to be added by applying fertiliser. Fertiliser rate recommendations are shown in Schedule 1 (page 24 & 25).

### **2.3.3 Fertiliser application methods**

Calibrate your fertiliser applicator each time you change the product you are applying.

Where feasible, apply fertiliser below ground, either stool split or directly beside the stool (no more than 600 mm from the stool). Placement at the centre of the inter-row is not recommended.

If fertilisers are applied on the surface, you should delay application until the cane has reached 50 cm in height. Surface banding of fertiliser is most effective when applied close to the stool.

After completing surface application of fertiliser, apply 20-25 mm of overhead irrigation, or apply within 48 hours of a strong possibility of rain showers.

If you use furrow irrigation, apply all fertiliser sub-surface unless it can be incorporated prior to irrigation.

If you apply your fertiliser via trickle irrigation, use no fewer than three split applications of nitrogen.

Biosolids (treated sewage sludge) from urban sewage treatment plants may be used as a source of nitrogen and organic matter. Guidelines for use are currently being developed by the DNR and CRC Sugar.

### **2.3.4 Fertiliser application rates**

Carry out regular analytical testing of your soils to determine their nutrient status.



**Treated effluent can be used for irrigation in some areas.**

Use the results of this soil testing to:

- ensure that the quantities of fertiliser you apply are matched to crop needs; and to
- determine whether nutrient leaching could be occurring.

Do not over apply fertilisers. Excessive nitrogen fertiliser application rates may lead to wasteful losses through:

- volatilisation and denitrification to the atmosphere;
- run-off in water; and
- leaching through the soil profile into underground aquifers.

These losses may have negative impacts elsewhere in the environment.

### 2.3.5. Use of mill by-products

Recycling and reuse of mill mud (filter cake) and boiler ash from sugar mills can provide plant nutrition and soil improvement benefits. Recycling supports the principles of ecologically sustainable development.

Sugar mills can give advice on typical nutrient composition, application rates and yield response data for mill mud and boiler ash.



**Recycling of mill mud provides plant nutrition and improves the soil.**

### What are the effects of fertiliser over-use?

Loss of fertilisers, particularly nitrogen and phosphorus, from the farm through run-off or leaching can have negative effects on the surrounding environment including:

- acidification of the soil profile;
- increased algal growth in watercourses and downstream; and
- contamination of groundwater.

It is in your best interest, both from an environmental and financial perspective, to minimise fertiliser loss from your farm. Matching fertiliser rates to crop needs is an important first step.

Tailwater recycling pits and artificial wetlands reduce the movement of nutrients off-site.

Stream bank vegetation can also act as a buffer, trapping sediment with attached phosphorus and extracting nitrates from ground water.

### 2.3.6 Managing saline and sodic soils

#### What are saline soils?

Saline soils are those in which the concentration of soluble salts in soil water is sufficient to restrict plant growth. These salts can be a combination of calcium, magnesium, sodium or potassium ions in association with chloride, sulfate, carbonate or bicarbonate ions.

#### What are sodic soils?

Sodic soils occur where sodium represents more than 10-15% of the elements attached to clay particles. Sodic soils may or may not be saline. Saline soils are usually also sodic.

The following techniques may prevent the development of saline and sodic soils or aid in their management:

- ensure that drainage schemes in potentially saline areas are coordinated across the catchment to minimise the effect of discharge of saline water;

- soil ameliorants such as gypsum should be applied;
- where practicable, retain harvesting residue to reduce soil sodicity;
- maintain an adequate topsoil layer to prevent subsoils (B-horizon soils) being exposed as a result of levelling or clearing;
- where subsoils are exposed during levelling, a topsoil layer should be returned;
- adopt good irrigation management practices to prevent rising water tables.

CRC Sugar is currently developing a tool kit for the identification and management of sodic soils.

#### Are you using best practice fertiliser management?

- ✓ Soil tests taken and records kept
- ✓ Advice obtained on fertiliser needs
- ✓ Potential for off-site losses minimised
- ✓ Fertiliser buried or incorporated if surface applied



*Choose the most suitable irrigation system for your needs.*

## 2.4 Irrigation

The choice of the most suitable irrigation system for your farm will be influenced by soil permeability, farm topography, water availability and your financial situation.

It is in your best interests to make every effort to maximise the efficiency of your irrigation system and to minimise water losses.

Irrigators should always comply with licence conditions attached to their irrigation licence.

### 2.4.1 Furrow irrigation

On free-draining, highly permeable soils, furrow irrigation is less suitable than overhead low pressure or trickle systems. Refer to Schedule 2 for current recommended practice.

### 2.4.2 Overhead irrigation

When using overhead irrigation systems make sure the system is calibrated to soil type.



*You can maintain soil fertility by appropriate use of fertilisers and soil ameliorants.*



***Make every effort to maximise irrigation efficiency and to minimise water losses.***

Green cane trash blanketing may be beneficial as the trash blanket slows water movement, allowing more time for infiltration and helps retain moisture in the root zone.

Take account of wind speed and direction to minimise water use and to reduce impact on non-target areas such as roads and houses.

Ensure strong cross winds do not blow water outside of the cropped area or cause uneven distribution of water within the field.

When using high pressure overhead systems, irrigate when conditions are calm or winds are light to moderate; still conditions are most common at night.

With centre pivot irrigation systems, take care to ensure that the application rate at the end-spans does not exceed the infiltration rate of the soil; with very large centre pivots, the application rate at the end-spans can be excessive.

### **2.4.3 Tailwater recycling**

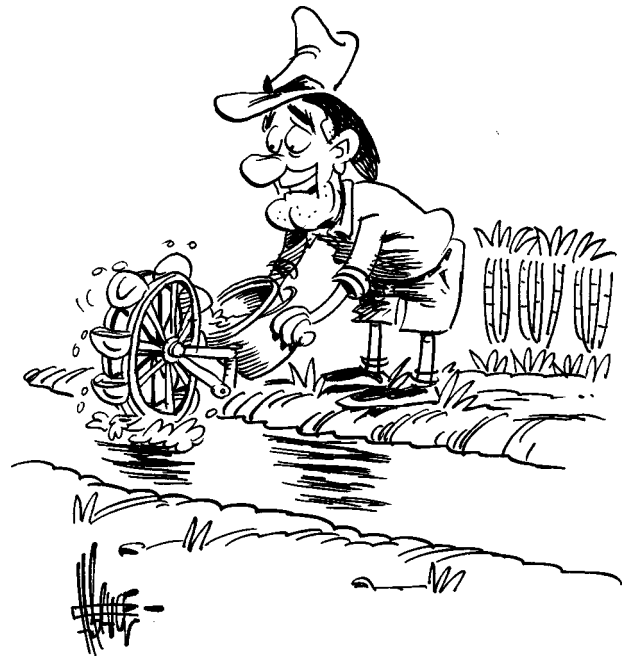
Consider the installation of tailwater storages where furrow irrigation is practised and/or where tailwater run-off occurs. This will:

- improve irrigation efficiencies;

- minimise run-off; and
- trap sediments, nutrients and chemicals suspended in run-off water.

Design of tailwater storages should ensure that off-farm run-off from irrigation does not exceed 10% of irrigation inflow rates.

Construct recycling storages in accordance with Department of Natural Resources Rural Advisory Service specifications: *Section B - Earth Dams* and/or *Section BM - Earth Dams with Membranes*.



***Installation of tailwater systems makes your water go further and reduces soil loss.***

### **2.4.4 Irrigation scheduling/ water efficiencies**

Schedule irrigation with evaporation mini-pans and/or soil probes calibrated to stalk growth measurements and soil type.

BSES target water use efficiencies are listed in Schedule 2 (page 26).

### **2.4.5 Treated waste water**

Effluent water should be applied only if -

- the effluent is of appropriate quality;
- the soils have appropriate permeability; and

- ground water is at sufficient depth to prevent its contamination.

Guidelines for the reuse of sewage sludge and effluent on cane are currently being developed by CRC Sugar and DNR.

**Are you using best practice irrigation techniques?**

- ✓ Suitable irrigation type
- ✓ Wind conditions taken into account for overhead systems
- ✓ Tailwater dam where appropriate
- ✓ Water use efficiency maximised
- ✓ Water quality monitored and managed

**2.5 Drainage**

Refer to the section on drainage in Developing New Lands

**2.6 Weed, pest & disease control**

**2.6.1 Integrated pest management**

Adopt Integrated Pest Management strategies wherever possible; this includes use of biological and cultural controls.

Risk of pest attack is dependent on local conditions including recent history of damage and the



*Eliminating grassy areas will help reduce rat numbers.*



*Adopt an Integrated Pest Management strategy wherever possible.*

suitability of certain soils for insect pests. Local BSES and/or Cane Protection and Productivity Board staff can advise on the likelihood of pest attack and methods to adopt which can reduce the risk of pest outbreaks or damage.

Follow regional best practices for the control of disease outbreaks.

Herbicides, insecticides and nematicides must be applied according to the directions on the label.

Retention of harvest residues from green cane harvesting will help reduce the number of weeds during the early establishment phase of ratoon crops; however, this may not minimise herbicide use.

Notification and management of declared weeds should be in accordance with the requirements of the Rural Lands Protection Board and local authorities.

**2.6.2 Rat control**

Integrated Pest Management strategies for control of cane rats focus on minimising weeds in cane and surrounding grass harbourage areas.

Cane rats feed on grass seeds which are high in protein and needed for reproduction. They also utilise grassy and weedy areas for shelter.

Quick-growing native trees can form a dense canopy in a few years, shading out weeds and grasses. Without these grassy areas, rats can not breed. Tree planting might thus be considered as an effective component of an integrated pest management program.

The use of Klerat ® is controlled by Damage Mitigation Permits issued by the Department of Environment. Its use is restricted to situations of high risk of damage under the proviso that numbers of rats are monitored annually.

### 2.6.3 Feral animals

Feral animals such as wild pigs can cause severe damage to cane crops but you are not permitted to pursue feral animals into National Parks and World Heritage Areas unless you have written permission from the Department of Environment.



**You are not permitted to pursue wild pigs into National Parks and World Heritage Areas without a permit.**

Management of native animals as economic pests must be conducted under the conditions of a Damage Mitigation Permit obtained either from the Department of Environment or Cane Protection and Productivity Boards.

## 2.7 Fire management

Cane firing must be in accordance with the established permit system.



**If you must burn your cane, strictly follow the rules as approved by the Rural Fire Council.**

General guidelines for cane firing can be found in the *Australian Sugar Industry Handbook* published by CANEGROWERS. The guidelines set out in the handbook have been approved by the Rural Fire Council.

Make every effort to retain, incorporate or otherwise dispose of tops rather than burning them.

Adopt green cane harvesting and trash blanketing where this approach is compatible with profitable cane growing.

## 2.8 Timing of operations and notifying neighbours

Endeavour to time your farm management operations, including cultivation and harvesting, so as to minimise impacts off the farm.

For example, noise causes less of a nuisance to neighbours if operations are restricted to agreed working hours.

Where practicable, notify any neighbours who may be affected by an operation *before* you start work.



**Dispose of chemical containers correctly - never dump them in a waterway or elsewhere.**

## 2.9 Fuel and dangerous goods - use and storage

Adhere to the *Code of Practice for Storage and Use of Chemicals at Rural Workplaces*. This is available from the Division of Workplace Health and Safety of the Department of Training and Industrial Relations. Copies have been supplied to all Queensland cane growers.

Attend an approved chemical accreditation course and participate in refresher courses.

### 2.9.1 Storage and bunding

Chemical storage should be in accordance with the *Code of Practice for the Storage and Use of Chemicals at Rural Workplaces*. Copies of the code are available from the Department of Training and Industrial Relations, Division of Workplace Health and Safety.

Store chemicals in a well-ventilated, secure and child-proof area constructed of Arc-mesh with impervious bunding, which has a capacity equivalent to 110% of the largest container being stored. Have equipment available to catch any spillage. Storage facilities should be situated clear of potential flooding.

Storage of diesel and petrol is regulated under

the *Flammable and Combustible Liquids Regulations*. These state that properties over five hectares in size involved in agriculture are exempt from licensing provisions but in any case, storages of less than 10 000 litres for diesel and 5000 litres for petrol are exempt.

The regulations are administered by local government authorities so you should check with your local Council on specific requirements. In any event, bunding of fuel storages is recommended to prevent any spillage contaminating the environment.

### 2.9.2 Chemical use

Keep comprehensive records of any usage of agricultural chemicals. Make a record each time you apply chemicals. The CANEGROWERS' *Farm Chemical Record Book* is a good example of a suitable book.

Remember that the label on an agricultural chemical container is a legal document and, together with the Material Safety Data Sheet for that product, must be read and followed for every application.



**Store farm chemicals properly and have equipment available to deal with any accidental spillage.**

Material Safety Data Sheets are available from your chemical supplier.

When you spray, ensure that you:

- do not exceed the label rate of the chemical or pesticide;
- use equipment which is correctly calibrated and maintained and is as safe as possible; and
- take particular care with application of S7 products, ensuring that all precautions specified on the label are strictly followed.

### 2.9.3 Managing off-site risks of spray drift and chemicals

Ensure that people and the environment are protected from potential harm from the use of agricultural chemicals. You will need to take particular care near sensitive crops, populated areas and waterways.

In particular:

- prior to spraying, **notify neighbours** who may be affected;
- take into consideration the **time of application**; and
- carry out spraying operations under appropriate **weather conditions**, ensuring that wind direction and speed will minimise drift.

Ensure that all equipment is calibrated and working effectively. Before each application, check the following:

- all nozzles are clear and spraying uniformly;



*Always read the label on chemical containers.*



*Before spraying, always make sure that you are wearing suitable safety gear and make sure that others are protected from harm.*

- pressure is according to specification; and
- correct height above the target is maintained.

Mix chemicals, fill chemical spray tanks and wash down equipment in appropriate areas away from any sites where contamination of watercourses or groundwater could occur.

The *Agricultural Chemicals Distribution and Control Act 1966* specifies that persons responsible for off-site damage to adjacent crops can be prosecuted. It also specifies that maximum residue limits for chemicals on cane must not be exceeded.

#### Do you use best practice when handling chemicals?

- ✓ Notify neighbours
- ✓ Equipment in good order & checked regularly
- ✓ Label & material safety data sheet read & followed
- ✓ Chemicals stored in well ventilated, lockable, bunded area
- ✓ Records kept
- ✓ Accreditation kept up to date

## 2.10 Waste management

Do not use creeks as a dumping ground for farm rubbish, empty containers, obsolete equipment or as a wash-down area for machinery and equipment.

Do not use waste oil for suppressing dust on unsealed roads and other bare areas or for the control of termites in timber.

### 2.10.1 Recycling

Commercial recycling options, if available, should be utilised to remove tyres, batteries, scrap metal, waste oil and any other recyclable wastes from farms. CANEGROWERS will



**Never dump rubbish, empty containers or old equipment on creek banks.**

lobby for the establishment of such facilities in all cane growing areas.

### 2.10.2 Chemical containers

Where possible, purchase chemicals in a form which will reduce container waste or facilitate container recycling, eg. granular products or refillable containers.

Remove the lids, triple rinse and puncture all used chemical containers and deliver to recycling depots or specified council landfills.

Chemical containers and bags must be disposed

of as specified in the *Code of Practice for the Storage and Use of Chemicals at Rural Workplaces*. Copies of this code are available from the Department of Training and Industrial Relations Division of Workplace Health and Safety.

Used chemical containers which require temporary storage prior to disposal should be triple rinsed, punctured and stored out of reach of flood waters.

## 2.11 On-farm monitoring

You can demonstrate that you use sustainable cane growing practices on your farm by keeping appropriate farm records and by monitoring and regularly reviewing your farming practices.

In addition to keeping productivity records and performance indicators, keep records of:

- all soil tests;
- agricultural chemical usage;
- use of fertilisers and soil ameliorants; and
- tree plantings and survival rates.

The CANEMAN block recording program may be one way of keeping these records.

Also, you should monitor:

- pest populations (rats, wireworms, canegrubs);
- water quality including irrigation water quality and quantity;



**Keep adequate records of your farming practices and monitor and review them regularly.**

# 3. Useful References

- ground water levels; and
- pH in high risk acid sulfate soil areas.

## Useful publications

### Available from CANEGROWERS

- Australian Sugar Industry Handbook
- Riparian Management - Is there a rat in your hip pocket?
- Farm Chemicals Record Book

### Available from your local BSES office

- Irrigation of Sugarcane
- Australian Sugarcane Pests
- Herbicide Application Manual for Canegrowers (BSES Publication No. 2/91)
- Chemical Weed Control in Sugarcane
- Australian Sugarcane Nutrition Manual by DV Calcino
- CANEMAN Block Recording Program

### Available from Queensland Government Division of Workplace Health and Safety

- Code of Practice for the Storage and Use of Chemicals at Rural Workplaces

### Available locally

- Johnstone River Catchment Management Strategy
- Pioneer River Catchment Management Strategy
- Strategic Plan of the Russell and Mulgrave

## Useful contact addresses and phone numbers:

### Bureau of Sugar Experiment Stations (BSES)

**Head Office:** 50 Meiers Road, Indooroopilly Qld 4068. Ph: (07) 3331 3333 Fax: (07) 3871 0383.

**Pathology Farm:** 24 Dandelion Street, Eight Mile Plains Qld 4113. Ph: (07) 3341 5443 Fax: (07) 3341 9823.

**Bundaberg:** Ashfield Road, Bundaberg Qld 4670. Ph: (07) 4159 3228 Fax: (07) 4159 3383.

**Burdekin:** Bruce Highway, Brandon Qld 4807. Ph: (07) 4782 5455 Fax: (07) 4782 5487.

**Herbert:** Fairford Road, Ingham Qld 4850. Ph: (07) 4776 2500 Fax: (07) 4776 3468.

**Mackay:** Peak Downs Highway, Te Kowai Qld 4741. Ph: (07) 4954 5100 Fax: (07) 4954 5167.

**Meringa:** Bruce Highway, Meringa Qld 4865. Ph: (07) 4056 1255 Fax: (07) 4056 2405.

**Tully:** Dallachy Road, Tully Qld 4854. Ph: (07) 4068 1488 Fax: (07) 4068 1907.

### Cane Protection and Productivity Boards

**Ayr:** PO Box 597, Ayr Qld 4807.

Ph: (07) 4783 1101 Fax: (07) 4783 5327.

**Babinda:** PO Box 56, Babinda Qld 4861.

Ph: (07) 4067 1576 Fax: (07) 4067 1576.

**Bingera:** Bingera Sugar P/L, Private Mail Bag, Bundaberg, Qld 4670. Ph: (07) 4157 7333 Fax: (07) 4157 7430.

**Fairymead:** PO Box 953, Bundaberg Qld 4670. Ph: (07) 4159 9171 Fax: (07) 4153 1986.

**Herbert:** PO Box 135, Ingham Qld 4850.

Ph: (07) 4776 1808 Fax: (07) 4776 3086.

**Inkerman:** PO Box 209, Home Hill Qld 4806. Ph: (07) 4782 1107 Fax: (07) 4782 2518.

**Invicta:** PO Box 957, Ayr Qld 4807.

Ph: (07) 4782 9129 Fax: (07) 4783 4914.

**Isis:** PO Box 95, Childers Qld 4660.

Ph: (07) 4126 1444, (07) 4126 1617

Fax: (07) 4126 1902.

**Mackay:** PO Box 117, Mackay Qld 4740.

Ph: (07) 4957 2381 Fax: (07) 4951 1167.

**Maryborough:** PO Box 172, Maryborough Qld 4650. Fax: (07) 4121 6115.

**Millaquin/Qunaba:** PO Box 953, Bundaberg Qld 4670. Ph: (07) 4151 2555

Fax: (07) 4153 1986.

**Moreton:** C/- PO Box 82, Nambour Qld 4560.

Fax: (07) 5441 5701.

**Mossman:** PO Box 191, Mossman Qld 4873. Ph: (07) 4098 1334 Fax: (07) 4098 1334.

**Mourilyan:** PO Box 77, Mourilyan Qld 4858. Ph: (07) 4063 2230 Fax: (07) 4063 2108.

**Mulgrave:** PO Box 21, Gordonvale Qld 4865.

Ph: (07) 4056 1045 Fax: (07) 4056 1838.

**Plane Creek:** PO Box 117, Mackay Qld 4740.

Ph: (07) 4956 1488 Fax: (07) 4956 2384.

**Proserpine:** PO Box 374, Proserpine Qld 4800.

Ph: (07) 4945 1844 Fax: (07) 4945 2721.

**Rocky Point:** C/- Secretary, 22 McIvor Court, Ormeau Qld 4208. Ph: (07) 5546 2315

Fax: (07) 5546 1233.

**South Johnstone:** PO Box 16, South Johnstone Qld 4859. Ph: (07) 4064 2302

Fax: (07) 4064 2600.

**Tully:** PO Box 514, Tully Qld 4854.

Ph: (07) 4068 1275 Fax: (07) 4068 2351.

## **CANEGROWERS**

**Bundaberg:** PO Box 953, Bundaberg Qld 4670.

Ph: (07) 4151 2555. Fax (07) 4153 1986.

**Burdekin:** PO Box 933, Ayr Qld 4807.

Ph: (07) 4783 1144. Fax (07) 4783 4702.

**Cairns:** PO Box 514, Gordonvale Qld 4865.

Ph: (07) 4056 1251. Fax (07) 4056 3669.

**Innisfail:** PO Box 32, Innisfail Qld 4860.

Ph: (07) 4061 1133. Fax (07) 4061 4577.

**Tully:** PO Box 514, Tully Qld 4854.

Ph: (07) 4068 1077. Fax (07) 4068 2351.

**Herbert River:** PO Box 410, Ingham Qld 4850.

Ph: (07) 4776 5350. Fax (07) 4776 5380.

**Isis:** PO Box 95, Childers Qld 4660.

Ph: (07) 4126 6166. Fax (07) 4126 6336.

**Mackay:** PO Box 117, Mackay Qld 4740.

Ph: (07) 4957 2381. Fax (07) 4951 1167.

**Maryborough:** PO Box 172, Maryborough Qld 4650. Ph: (07) 4121 4441. Fax (07) 4121 6115.

**Mossman:** PO Box 100, Mossman Qld 4873. Ph: (07) 4098 2377. Fax (07) 4098 2233.

**Proserpine:** PO Box 374, Proserpine Qld 4800.

Ph: (07) 4945 1844. Fax (07) 4945 2721.

**Southern:** CANEGROWERS' Building, Lowe Street, Nambour Qld 4560. Ph: (07) 5441 2223. Fax (07) 5441 2944.

## **Cooperative Research Centre for Sustainable Sugar Production (CRC Sugar)**

Sir George Fisher Building, James Cook University, Townsville Qld 4811. Ph: (07) 4781 5763 or (07) 4781 5762, Fax: (07) 4781 5506. Email: [crc.sugar@jcu.edu.au](mailto:crc.sugar@jcu.edu.au)

## **CSIRO Townsville**

Davies Laboratory, University Road, Aitkenvale Qld 4814. Ph: (07) 4753 8500

Fax: (07) 4753 8650.

## **Department of Environment (DoE)**

**Far North Regional Centre:** PO Box 2066, Cairns Qld 4870. Ph: (07) 4052 3092.

**Northern Regional Centre:** PO Box 5391, Townsville Mail Centre, Qld 4810.

Ph: (07) 4722 5211.

**Southeastern Regional Centre:** GPO Box 2771, Brisbane Qld 4001. Ph: (07) 3224 5641.

## **Department of Natural Resources (DNR)**

**Mareeba:** 167 Walsh Street, Mareeba Qld 4800.

Ph: (07) 4092 2555 Fax: (07) 4092 3939.

**Nambour:** 52-64 Currie Street, Nambour Qld

4560. Ph: (07) 5430 0900 Fax: (07) 5430 0960.

**Resource Science Centre:** Block A, 80 Meiers Road, Indooroopilly Qld 4068.

Ph: (07) 3896 9506 and (07) 3896 9332.

**Townsville:** 187-209 Stanley Street, Townsville Qld 4810. Ph: (07) 4722 1201.

**Waterwatch Coordinator:** Ph: (07) 3896 9737

Fax: (07) 3896 9625 Mobile: 0419 641 024

Email: [turnerl@Iris1.ind.dpi.qld.gov.au](mailto:turnerl@Iris1.ind.dpi.qld.gov.au)

## **Department of Primary Industries (DPI)**

**Call Centre for all enquires** Ph: 132 523.

# Schedule 1

## Advice on fertiliser use

*Supplied by Cooperative Research Centre for Sustainable Sugar Production (CRC Sugar)*

Fourteen essential nutrients are required to produce healthy and well-nourished sugarcane. For convenience, and to indicate the relative requirement by plants, these are often divided into two groups: macro and micro nutrient.

Of all the nutrients, the six macro elements - nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg) and sulphur (S), are most often applied to crops. However, micro-nutrients are equally important, even though they are required in much smaller quantities.

Balanced nutrition is extremely important – although some nutrients are needed in greater quantities, they are ALL considered essential. Those that are absent or at low concentrations in the soil need to be added by applying fertiliser. Devastating effects on crop growth and yield are possible if nutrient deficiencies occur. Imbalance of nutrients can also affect crop yields, as over-availability of one element may adversely affect the availability of another.

Soil and/or leaf testing serves to determine which

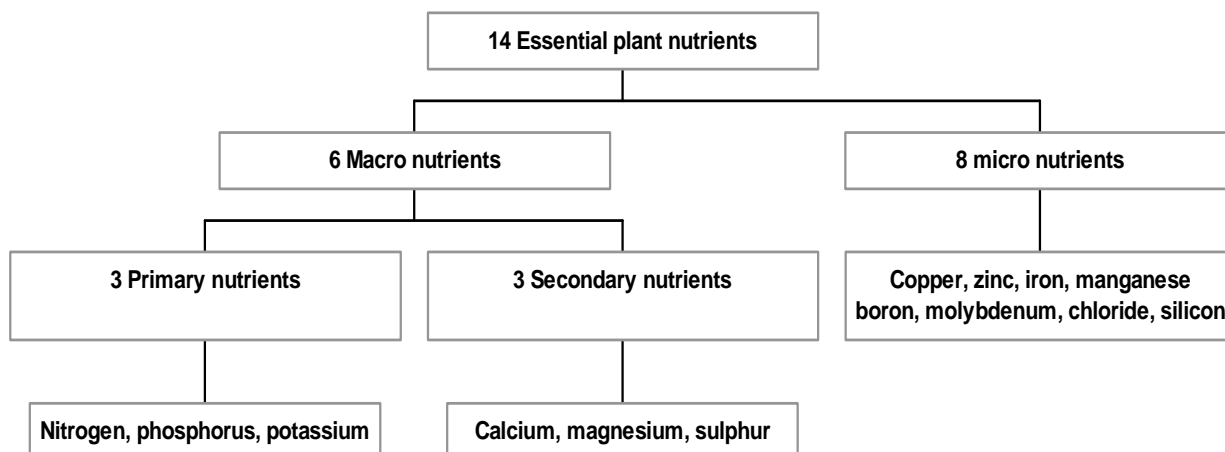
nutrients need to be applied to ensure well nourished sugarcane. While soil testing is useful in regard to most of the macro nutrients, leaf analysis is more relevant for assessing the uptake of micro nutrients by crops.

Balanced sugarcane nutrition can only be achieved by:

- Regular soil and leaf sampling to determine the nutrient status of the crop.
- Applying those nutrients which are needed
- Not over-applying one nutrient at the expense of the others.

The keeping of field management records is encouraged. An ongoing record of the fertility status of the soil and crop will ensure that unfavourable fertility trends do not occur on the farm. This will have a beneficial effect on farm budgets and ensure long-term sustainability.

The *Australian Sugarcane Nutrition Manual* by DV Calcino is a practical guide and reference on most aspects of sugarcane nutrition. It includes information about the role of nutrients, deficiency and toxicity symptoms, and guidelines on how to collect representative soil and sugarcane leaf samples. Table 1 contains a summary of seven of the most widely applied nutrients in the industry. However, it should be noted that the established recommendations are currently under review. Modified advice, which is more soil, region and variety specific, and takes green



**Table 1 - BSES Fertiliser Recommendations**

Nutrient	Criteria/soil critical values		Recommended rate (kg/ha)			
			Burdekin & Mareeba		All other districts	
Nitrogen	Broad soil type and crop					
	All soil types (except dryland and/or richland)*	Fallow plant Replant & ratoon	135-150	120-150		
			210-250	160-200		
		All districts				
	Dryland and/or richland	Fallow plant Replant & ratoon	80			
			120			
Nitrogen rates for plant cane can be reduced following a heavy legume crop and when growing vigorous cane varieties which are prone to lodging.						
Phosphorus	Critical value (0.005M H <sub>2</sub> SO <sub>4</sub> ) = 20 mg/kg		High yield (>120t/ha)		Lower yield (<120t/ha)	
			Plant	Ratoon	Plant	Ratoon
	Soil P (mg/kg)					
	< 6		80	40	80	25
	6-10		80	40	40	25
	11-20		40	40	25	25
	21-40		20	20	20	20
	>40		20	nil	20	nil
Potassium	Critical value (0.02M HCl) = 0.24cmol(+)/kg		Plant		Ratoon/replant	
	Soil K (cmol(+)/kg)	**Nitric acid K (cmol(+)/kg)				
	<0.24	<0.2	100	120		
	<0.24	0.2-0.6	80	100		
	>0.24	>0.6	Reduced rate	Reduced rate		
Calcium	Critical value (0.02M HCl) = 0.55cmol(+)/kg					
	Soil Ca (cmol(+)/kg)		Tonnes lime /ha			
	<0.55		5.0			
	0.55-1.25		2.5			
	>1.25		nil			
Magnesium	Critical value (0.02M HCl) = 0.10 cmol(+)/kg					
	Soil Mg (cmol(+)/kg)					
	<0.10		160 (300 kg/ha MgO or 1.6 t/ha dolomite)			
	0.10-0.25		80 (150 kg/ha MgO or 0.8 t/ha dolomite)			
	>0.25		nil			
Sulphur (as sulphate)	Critical value (0.01M Ca dihydrogen ortho-phosphate) = 3 mg/kg					
	Soil sulphate sulphur (mg/kg)					
	0-2		25			
	3-7		10			
	>7		nil			
Zinc	Critical value (0.1M HCl) = 0.6 mg/kg					
	Soil Zn (mg/kg)					
	<0.6		10			
	>0.6		nil			

\* Dryland: areas receiving less than 1200 mm of annual rainfall and no irrigation.  
Richland: usually recent alluvial or peaty soils.

\*\* Nitric acid K = 1M nitric acid soluble K

# Schedule 2

cane trash blanketing into account, may be more appropriate in future.

water application should exceed crop requirements to ensure that salts do not accumulate in the soil.

## BSES Achievable Water Use Efficiencies

Supplied by Bureau of Sugar Experiment Stations (BSES)

Based on a given irrigation system, the following targets, calculated as tonnes cane produced per megalitre (ML) of water used, are achievable (Table 1).

The targets apply generally across all districts and include effective rainfall calculated on a daily basis. For an effective rainfall figure contact your local BSES. There will be variations within districts from farm to farm.

Where moderate or high salinity water is used, pressure or trickle systems. Table 2 outlines current recommended practice by the BSES when furrow irrigating.

On free-draining, highly permeable soils, furrow irrigation is less suitable than overhead low

**Table 1. Target Water Use Efficiencies**

Tonnes/ML	
Furrow irrigation	7**
Overhead irrigation	8
Trickle irrigation	10

\*\*A slightly lower figure of 6 tonnes/ML applies for the Burdekin Delta to allow for aquifer replenishment.

**Table 2. BSES Guidelines for Furrow Irrigating**

CONSIDER SOIL PERMEABILITY WHEN FURROW IRRIGATING	
<i>Tailwater recycling is recommended for furrow irrigation systems on all soil types wherever this is feasible.</i>	
Free-draining	Where furrow irrigation is used, reduce deep drainage losses by changing the water furrow from a broad base U shape to a narrow V shape and reduce furrow length.
Cracking clay clay soils	Most water loss on these soils is through tailwater run-off. After the soils “wet up”, water infiltration is very slow. Irrigation efficiencies will be improved by tailwater recycling and can be maintained with long furrow lengths.
Medium to heavy	Tailwater is the main loss of water from these soils. Tailwater recycling will improve irrigation efficiencies.
Moderately permeable soils	Practice reduced tillage especially in the plant crop.
Surface sealing soils	<b><i>Soils with water penetration problems</i></b> After the last cultivation irrigate with low inflow rates (<1L/second); wide U shaped furrows are best. Use a soil ameliorant such as gypsum or lime to open up the soil surface taking care not to apply excessive amounts

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