

# GAMECHANGER 2016

INNOVATION IN SUGARCANE



Australian Government



## ABOUT GAMECHANGER

The GameChanger project has developed and trialled management practices in the Mackay Whitsunday, NQ Dry Tropics and Terrain NRM regions with a focus on the use of precision agriculture technologies and advanced planning to provide opportunities for cane farming to be more economically and environmentally sustainable.

GameChanger is supported by NRM Groups across Queensland, through funding from the Australian Government.

GameChanger supports farmers to adopt strategies where evidence has shown they can be applied across farms with sound economic outcomes while significantly increasing the cuts to sugarcane pollutant runoff.

## CONNECTED TO PROJECT CATALYST

The GameChanger management practices are an extension of the Project Catalyst activities where technologies and techniques are generally at a higher level than the best management practices identified in the regional ABCD frameworks.

This project has generated evidence for these practices to be promoted to the greater industry for wide scale adoption, where they have the potential to significantly reduce anthropomorphic runoff whilst maintaining farm productivity and profitability.

Project Catalyst is making a valuable contribution to the effort to preserve the Great Barrier Reef and improve farm efficiencies. To date, Project Catalyst growers in Queensland have helped improve the quality of more than 150 billion litres of water flowing to the Great Barrier Reef. Read more at [www.catchmentsolutions.com.au/rural-production-innovation/project-catalyst/](http://www.catchmentsolutions.com.au/rural-production-innovation/project-catalyst/)

The good work being done under Project Catalyst is now being extended across Queensland through the GameChanger program, with the intent of significantly increasing a wider uptake of practice change by sugarcane growers.

## OUTCOMES GAMECHANGER

### Education is key

Significant outcomes in terms of grower learning are being realised for GameChanger activities across the three distinct Natural Resource Management (NRM) regions, increasing long-term potential for the uptake of validated practice change.

## GAMECHANGER REGIONS – WHO'S INVOLVED IN GAMECHANGER?

- **Mackay and the Whitsundays** GameChanger is managed by Reef Catchments NRM
- **Dry Tropics** GameChanger is managed by NQ Dry Tropics NRM
- **Wet Tropics** GameChanger is managed by Terrain NRM

Grower led and grower driven with practical farming outcomes aimed at improving water quality was the primary focus of the GameChanger project. To achieve this the project sought to expand on the success of Project Catalyst and engage with a wide selection of growers throughout the three (3) NRM regions to search for innovative ideas on nutrient and chemical management that addressed improved water quality entering the Great Barrier Reef (GBR) lagoon.

Growers involved in the project initially attended a series of project overview meetings within the regions where project objectives and outcomes were outlined. From these meetings growers presented ideas and suggestions for the trialling and adoption of practical farm management improvements aimed at fast tracking adoption of practices and/or technologies with a focus on improved nutrient and herbicide management to improve water quality outcomes.

**SEVENTY (70) GROWERS IN ASSOCIATION WITH AGRONOMIC AND ECONOMIC SERVICE PROVIDERS WERE ENGAGED TO ADOPT SEVERAL KEY FARM MANAGEMENT PRACTICE CHANGES AS DETAILED IN TABLE 1. THE LOCATIONS OF ALL TRIAL SITES ARE SHOWN IN FIGURES 2, 3, 4 AND 5.**

**Table 1 - GameChanger activities undertaken in all NRM regions**

## TERRAIN NRM REGION

Trial No	Mill region	Topic	Project Consultant
<b>GameChanger activities conducted in the Terrain NRM region</b>			
1	Mossman	Refining nutrient management with detailed PA data	Mossman Ag Services
2	Mossman	Entrench compared against standard fertiliser	Mossman Ag Services
3	Mossman	Use of Ezi-Grade to improve water drainage	Mossman Ag Services
4	Mossman	Entrench compared against standard fertiliser	Mossman Ag Services
5	Mossman	Dual Herbicide Sprayer	Mossman Ag Services
6	Mossman	Use of Ezi-Grade to improve water drainage	Mossman Ag Services
7	Mossman	CR and Entec compared against standard fertiliser	Mossman Ag Services
8	Tully	Record spot spraying GPS points to develop a variable rate spraying map	T.R.A.P. Services
9	Tully	Reduced nitrogen on final ratoon block	T.R.A.P. Services
10	Tully	Compare Entec with Urea	T.R.A.P. Services
11	Tully	Reduced nitrogen on late cut final ratoon block	T.R.A.P. Services
12	Tully	Can mill mud be used as a nutrient source for a final ratoon crop	T.R.A.P. Services
13	Tully	Compare Entec and reduced N with Urea	T.R.A.P. Services
14	Herbert	Use of Corn as a rotation crop	HCPSL
15	Herbert	Banded fly ash with reduced nutrient application	HCPSL
16	Herbert	Improving sodic soils	HCPSL
17	Herbert	Controlled release fertiliser	HCPSL
18	Herbert	Entec Vs Standard Vs Mixed	HCPSL
19	Herbert	Reduced Entec Vs Standard (Same \$ VALUE)	HCPSL
20	Herbert	Reduced nutrients on late cut old ratoons	HCPSL



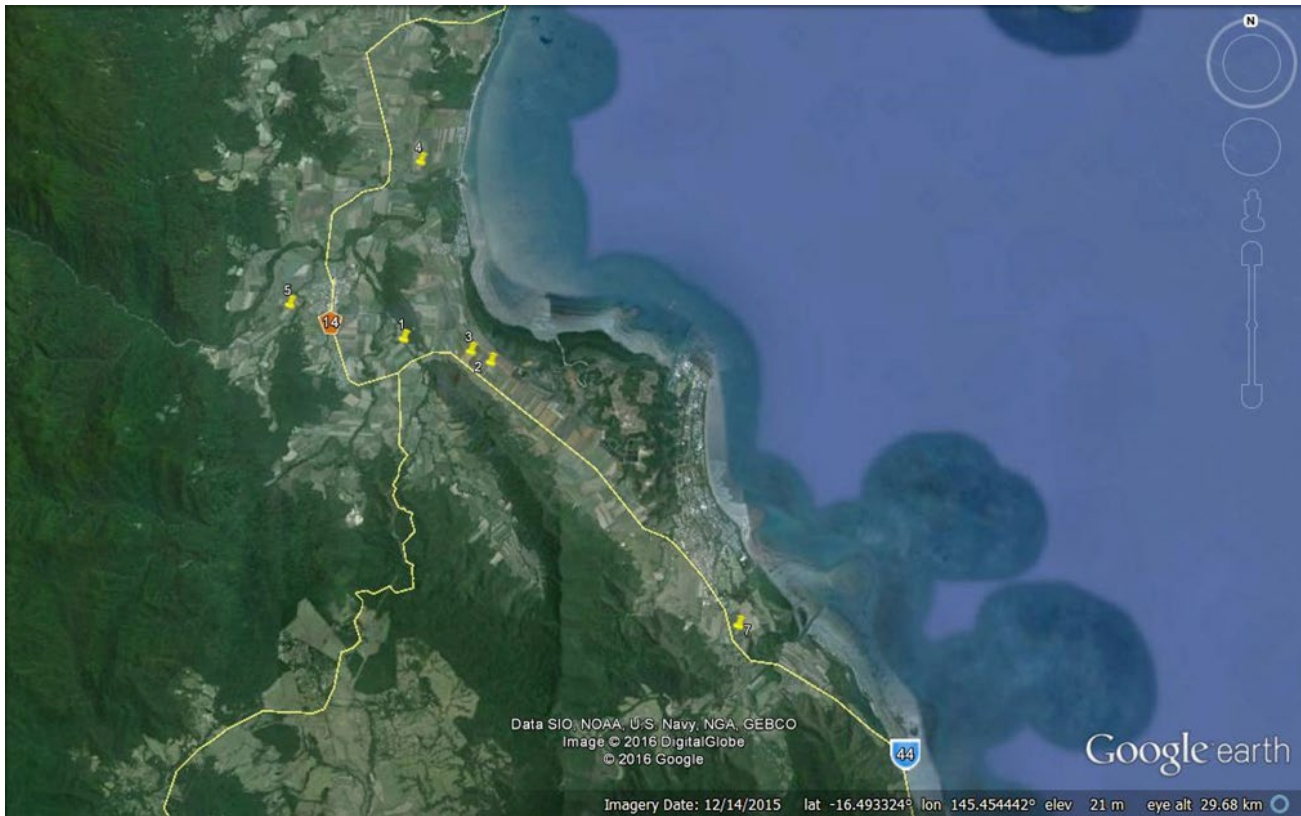
## NQ DRY TROPICS NRM REGION

Trial No	Mill region	Topic	Project Consultant
<b>GameChanger activities conducted in the NQ Dry Tropics NRM region</b>			
1	Burdekin	Enhanced Efficiency Fertiliser	Farmacist
2	Burdekin	Enhanced Efficiency Fertiliser	Farmacist
3	Burdekin	Enhanced Efficiency Fertiliser	Farmacist
4	Burdekin	Enhanced Efficiency Fertiliser	Farmacist
5	Burdekin	Enhanced Efficiency Fertiliser	Farmacist
6	Burdekin	Enhanced Efficiency Fertiliser	Farmacist
7	Burdekin	Enhanced Efficiency Fertiliser	Farmacist
8	Burdekin	Enhanced Efficiency Fertiliser	Farmacist
9	Burdekin	Enhanced Efficiency Fertiliser	Farmacist
10	Burdekin	Enhanced Efficiency Fertiliser	Farmacist
11	Burdekin	Enhanced Efficiency Fertiliser	Farmacist
12	Burdekin	Enhanced Efficiency Fertiliser	Farmacist
13	Burdekin	Automated irrigation	Farmacist
14	Burdekin	Automated Irrigation	Farmacist
15	Burdekin	Low cost alternative irrigation	Farmacist
16	Burdekin	Low cost alternative irrigation 2	Farmacist
17	Burdekin	Alternative mill mud treatments	Farmacist
18	Burdekin	Alternative mill mud treatments	Farmacist
19	Burdekin	Alternative mill mud treatments	Farmacist
20	Burdekin	Alternative mill mud treatments	Farmacist

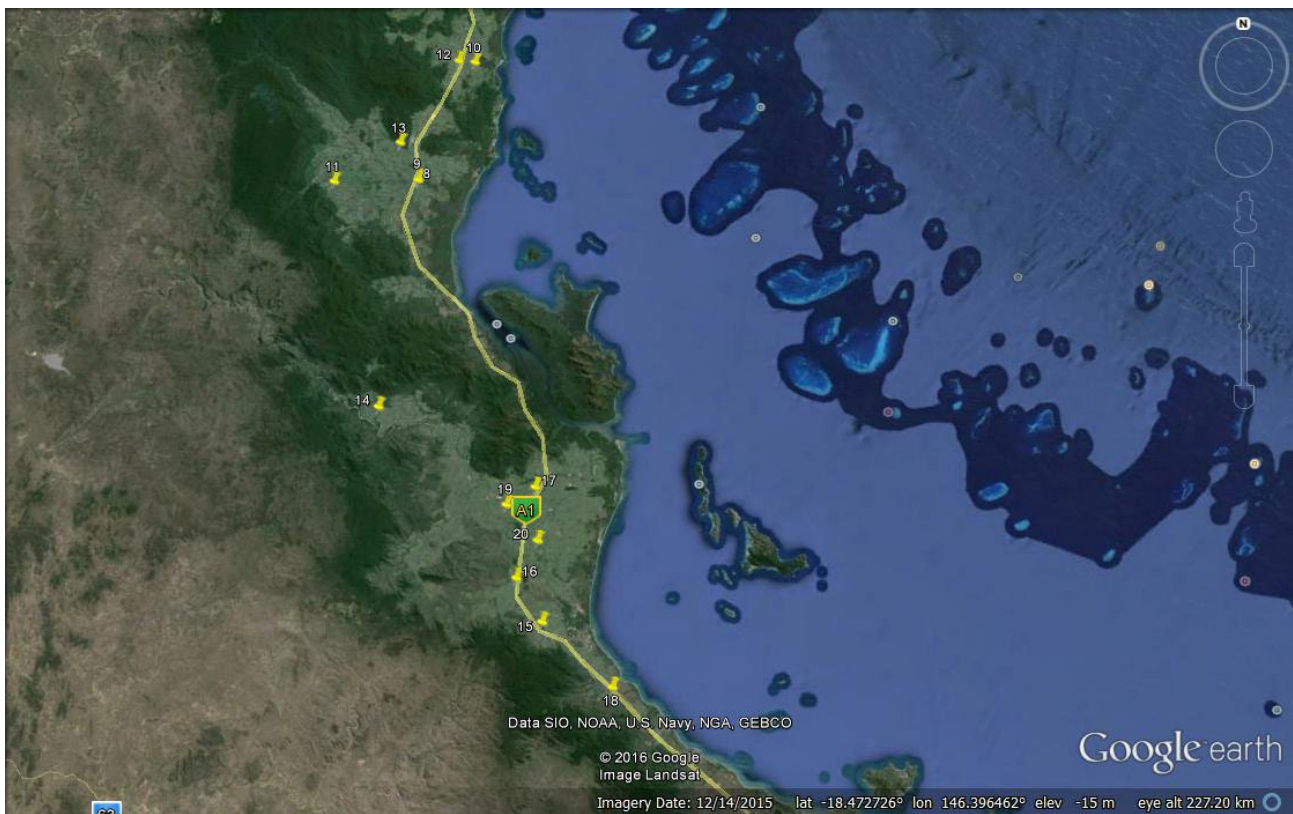


## MACKAY-WHITSUNDAY NRM REGION

Trial No	Mill region	Topic	Project Consultant
<b>GameChanger activities conducted in the Mackay-Whitsunday NRM region</b>			
1	Mackay	Buried mud application Vs Surface applied	Farmacist
2	Mackay	Variable Rate (VR) nutrient based on yield zones	Farmacist
3	Mackay	Variable Rate (VR) nutrient based on yield zones	Farmacist
4	Mackay	Reduced nutrient for older ratoons	Farmacist
5	Mackay	Variable Rate (VR) nutrient based on yield zones	Farmacist
6	Mackay	Variable Rate (VR) N based on yield zones	Farmacist
7	Mackay	Variable Rate (VR) nutrient based on yield zones	Farmacist
8	Mackay	Reduced nutrient for older ratoons	Farmacist
9	Plane Ck	Using Enhanced Efficiency Fertiliser (EEF) vs standard nutrient applications	Farmacist
10	Mackay	Using Enhanced Efficiency Fertiliser (EEF) vs standard nutrient applications	Farmacist
11	Proserpine	Use of lime amelioration to improve Nitrogen Use Efficiency (NUE)	Farmacist
12	Plane Ck	Residuals Vs Knockdown Herbicide	Farmacist
13	Mackay	Residuals Vs Knockdown Herbicide	Farmacist
14	Mackay	Variable Rate (VR) nutrient based on block yield	Farmacist
15	Mackay	Variable Rate (VR) nutrient based on block yield	Farmacist
16	Mackay	Variable Rate (VR) nutrient based on yield zones	Farmacist
17	Proserpine	Reduced nutrient for older ratoons	Farmacist
18	Plane Ck	Variable Rate (VR) herbicide based on soil properties	Farmacist
19	Proserpine	Using compost to improve Nitrogen Use Efficiency (NUE)	Farmacist
20	Mackay	Enhanced Efficiency Fertiliser	MAPS
21	Mackay	Reduced N on late harvest ratoons	MAPS
22	Mackay	Alternative herbicide strategies	MAPS
23	Plane Ck	Reducing residual herbicide with shielded sprayer	PCPSL
24	Plane Ck	Reducing N following a legume crop	PCPSL
25	Plane Ck	Variable Rate (VR) herbicide application based on soil properties	PCPSL
26	Plane Ck	Reduced N application in older ratoons	PCPSL
27	Proserpine	Reduced N rates on older ratoons	SSP
28	Proserpine	Reduced N rates on older ratoons	SSP



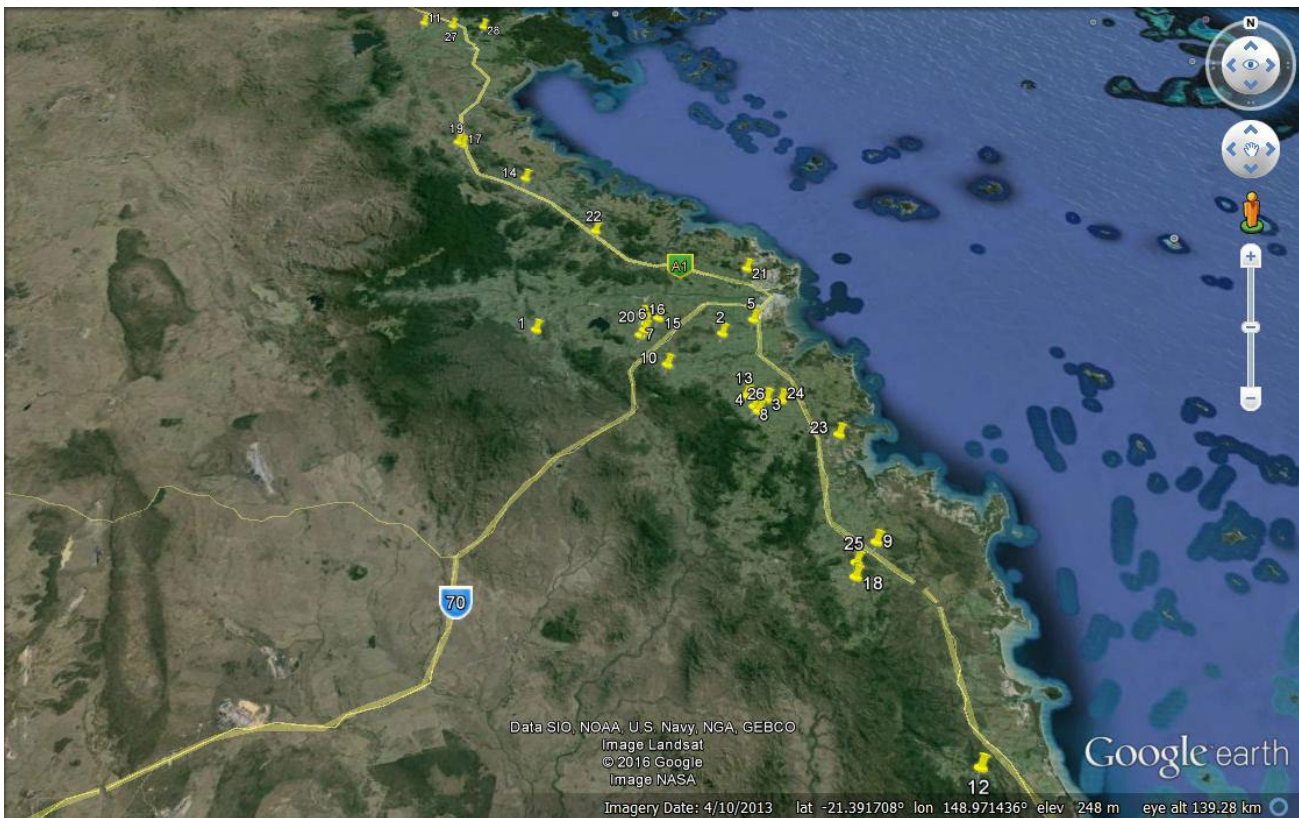
**FIGURE 2** Mossman region trial locations



**FIGURE 3** Herbert-Tully region trial locations



**FIGURE 4** Burdekin region trial locations



**FIGURE 5** Mackay-Whitsunday region trial locations

THIS PROJECT IS COORDINATED ON-GROUND BY REEF CATCHMENTS, MADE POSSIBLE THROUGH FUNDING FROM THE AUSTRALIAN GOVERNMENT REEF PROGRAMME.



## GROWERS AND THEIR SERVICE PROVIDERS IN EACH REGION ESTABLISHED FARM PLANNING AND CHANGE ADOPTION PROGRAMS THAT WERE INTRODUCED ON FARMS.

Assessments of the results of adopted practice change were conducted, and included: production, water quality, soil health and economics.

Practice change to date by GameChanger growers have provided improvement in:

- **Agronomy** – Agronomists were engaged in the program to provide expertise for the growers to better match farming practices more closely to crop needs such as fertiliser and herbicide applications.
- **Environment** – Water quality has been assessed as part of the program utilising rainfall simulation techniques and water quality autosamplers to determine the environmental footprint of cane farming, limiting nitrogen and chemical runoff and caring for soil and water.
- **Economics** – Agricultural economists from the Department of Agriculture and Fisheries were engaged to assess selected trial information to determine the economic benefits derived from adopted practice changes such as removing unnecessary operations, better allocation of fertiliser and herbicide and improved irrigation management.

The validation of results for the majority of trials implemented is a strong endorsement for practice change to improve environmental sustainability of the industry.

## THE ANALYSIS OF DATA FROM TRIAL SITES HARVESTED DURING THIS PROJECT HAS VALIDATED AND BROUGHT SOME CLARITY AND CERTAINTY TO PRACTICES IDENTIFIED AS HAVING POTENTIAL IN REDUCING THE LOSS OF NITROGEN AND HERBICIDES INTO WATERWAYS AND THE GREAT BARRIER REEF.

## SELECTED TRIAL RESULTS:

### Enhanced Efficiency Fertilisers (EEF)

The Enhanced Efficiency Fertiliser Trials were designed to identify production differences between N formulations and ratios based on different soil types, application rates and application timings throughout the year against traditional N treatments such as Urea.

### Summary of Results:

- Urea applied at 220 kg N and EEF applied at 180 kg N in the Burdekin sites indicated little difference in cane and sugar yields between treatments. This outcome is encouraging and shows strong potential for economic and environmental advantages from reduced N application rates.
  - EEF applications and the lower Urea rates had improved Nitrogen Use Efficiency (NUE) compared to high urea rates.
- In Mackay trials, Agrocote applied at 135 kg N had no difference in cane or sugar yields compared to Urea applied at 184 and 170 kg N. Again, this outcome is encouraging and shows strong potential for economic and environmental advantages from reduced N application rates.
  - There was a significant improvement in NUE for Agrocote treatments compared to the Urea treatments.
  - Similar results were also achieved in selected EEF trials conducted in the Terrain NRM region.
- The EEF applications had slightly improved CCS compared to Urea applications.
- EEF's appear to improve quantity of DIN lost from runoff.



## ALTERNATIVE MUD APPLICATIONS

### Burdekin:

The traditional application of mill mud in the Burdekin region is to apply the product in the water furrows at rates of approximately 200 t/ha (wet weight). With a heavy reliance on furrow irrigation there has been concerns that this application may be contributing to off site movement of nutrient, particularly P. The Burdekin trials compared furrow treatments of 100 and 200 t/ha application against on-the-row banded application at rates of 65 t/ha.

### Summary of Results:

- High rates of mill Mud/Ash conventionally applied impact water quality, particularly in P loss.
- Mud is a valuable source of nutrient which needs to be managed appropriately to reduce off site movement.
- Application of banded product onto the cane row in the Burdekin had some residual product remaining on the hill in the following year.
- This GameChanger project has resulted in the commercialisation of two banded mud applicators in the Burdekin region.

### Mackay:

Mill mud applied in banded row applications at rates of below 70 tonnes per hectare is considered to be an A class practice for nutrient management in the Mackay region. Results from trials conducted in the region have indicated that plant nutrient uptake rates and cane yields when mud is surface applied in bands on or near the plant growth zone are comparable to that of granular applied nutrients at industry standard (Six Easy Steps 6ES) rates. A thought amongst growers is that banded mud applied sub surface may increase the plant response to the mud applied and also further improve water quality leaving the cane block.

### Summary of Results:

- All nutrients for the top up fertiliser application were reduced to take into account the nutrients made available from the mud applications. Both the buried and surface applied applications received the same reductions.
- There is no significant difference in cane and sugar yields between treatments.
- Dirt in cane levels for buried mud treatments were lower than surface applied treatments, a positive outcome.

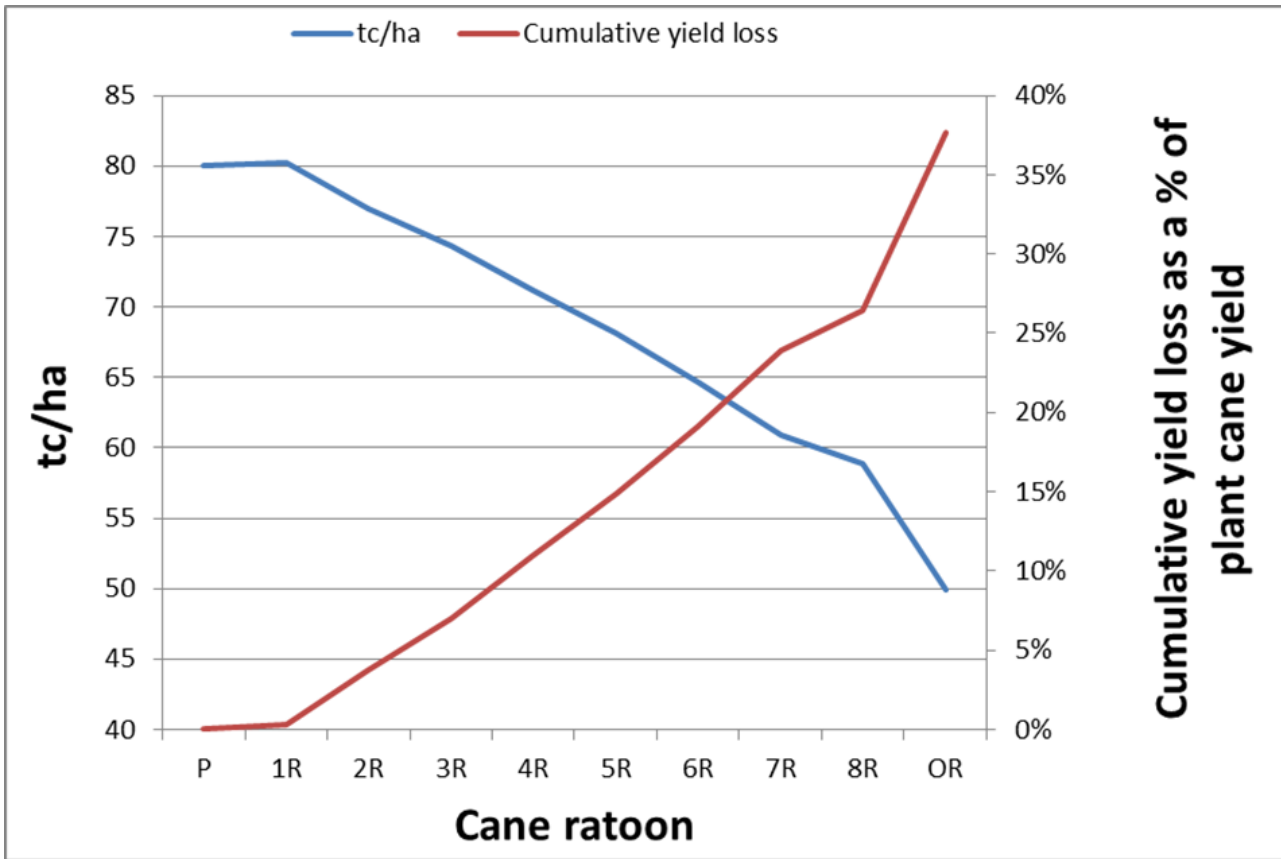
## REDUCED NUTRIENT APPLICATIONS IN LAST RATOON CROPS

Despite the best management efforts of growers, yield loss associated with aging ratoons occurs within all sugar cane blocks and across all cane varieties. Recent investigations reported that plant and 1st ratoon cane yields are almost identical with yield loss beginning in 2nd ratoons and continuing at a constant decline at a rate of approximately 4% to 5% per year. Cumulatively the yield loss (as expressed against the yield achieved as plant cane) reaches 17.5% by 5th ratoon, 25% by 7th ratoon and accelerates sharply to 37% for ratoons older than 8 years (Figure 1).

Trials were conducted during the project where N application rates in the last ratoon crops were reduced by 10% to 25% as compared with standard grower application rates.

### Summary of Results:

- In almost all cases lower rates of nutrients applied to older ratoon did not significantly impact on cane and sugar yields.
- Generally, there is an improved economic outcome when nutrient rates are reduced in older ratoon crops.
- This outcomes suggests strong potential for scope to improve nitrogen use efficiency of older ratoons by decreasing N application rates in line with yield decline for both economic and environmental advantages.



**FIGURE 1** Impact on cane yield from aging ratoons and the cumulative loss as expressed against plant cane yield



Growers attending the Burdekin GameChanger information session

**THIS PROJECT GENERATED SIGNIFICANT AGRONOMIC, ECONOMIC AND ENVIRONMENTAL EVIDENCE TO ALLOW SUCCESSFUL PRACTICE CHANGE PROGRAMS TO BE PROMOTED TO THE GREATER INDUSTRY FOR WIDE SCALE ADOPTION AND INTEGRATION INTO THE REEF PROGRAMME WATER QUALITY IMPROVEMENT GRANTS PROGRAM.**

## REDUCED NUTRIENT APPLICATIONS IN LOCATIONS OF LOW YIELD POTENTIAL

Through analysis of archived satellite yield data over an extended period, identifying the locations of defined management zones at an intra-paddock scale can be achieved. Targeted trials have shown that there is the potential to improve nitrogen use efficiency without compromising yield by reducing N rates in zones with low yield potential. Several sites throughout the Mackay region were trialled in the GameChanger project by varying rates according to yield potential of the management zones.

### Summary of Results:

- Results indicated that in the majority of sites, the higher yielding zone where N rates applied were maximised maintained the highest cane yields.
- In the low yielding zone where low rates of N were applied, yields did not reduce when compared to the higher rates applied in the same yield zones.
- The nitrogen use efficiencies calculated for the trial sites also indicated that the highest efficiencies existed in locations where higher N rates were applied in the highest yielding and the lowest efficiency exists where high N rates were applied in the lowest yielding zones.

- The sugar yields at this site also re-affirmed the significant variations in yields. Sugar yields in the higher yield zones were sometimes more than double those achieved in the lower yielding zone.
- These findings suggest strong potential for improved N application efficiencies, by reducing N rate on lower yielding zones where a higher rate of application has no impact.

The continued success of Project Catalyst coinciding with the GameChanger program in the three NRM regions has created an appetite for change amongst both participating as well as non-participating Catalyst and GameChanger growers.





With thanks to photo contributors Reef Catchments Limited,  
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