

Central Region sugarcane management practices

ABCD Management Frameworks



mackay area productivity services



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CANEGROWERS



A 'path for improvement' for growers and the extension staff who support them



PR09-xxxx

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The Department of Primary Industries and Fisheries (DPI&F) seeks to maximise the economic potential of Queensland's primary industries on a sustainable basis.

This publication has been compiled by <insert NAME/S> of <insert BUSINESS GROUP>.

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Introduction

The Property Management Systems Initiative (PMSI) project is a three-year project designed to assist in the implementation of property or farm management systems in both the O'Connell River and Bakers Creek catchments in the Mackay Whitsunday area of the Central Region. A main objective of the project is *to take a total systems approach across paddock to farm to catchment practice so that growers can identify where productivity and profitability gains can be made at all levels of their farming enterprise and the benefits to the region-wide community from incorporating economic, environmental and social sustainability into these improved practices.*

The partners in the PMSI project (Mackay Whitsunday Natural Resources Management (MWNRM) group; BSES; CANEGROWERS (Mackay and Proserpine); Department of Primary Industries and Fisheries (DPI&F); Mackay Sugar Cooperative Association Limited (MSCAL); Mackay Area Productivity Services (MAPS); Proserpine Cooperative Sugar Milling Association Limited (PCSMAL) and Plane Creek Mill (CSR)) undertook to add to the work already done by the MWNRM group Water Quality Improvement Plan (WQIP) ABCD frameworks for soil, chemical and nutrition, and also include four more facets of cane management: harvesting, water, business/finance and workplace health and safety. While additional knowledge gaps will undoubtedly come to light we are happy to present this document as the first draft of a Farm Management System of groups of practises that farmers are encouraged to adapt, for the maintenance of profitability and productivity of the Central Region sugarcane industry. This framework enables a continuous improvement process in holistic farm management.

In an honest attempt to strengthen the existing social capital of the industry seven groups of approximately ten people, made up of industry, Government and sugarcane growers, men and women, were formed to review and

improve each of the identified management aspects. The ABCD framework template, developed by John Drewry, Will Higham and Carl Mitchell for the soil, nutrition and chemical systems, was expanded to include the additional facets. Each of the groups met individually to consider their particular approach to their framework, which was later presented in a plenary session to the wider group for comment.

There is much to be done to improve overall industry knowledge of all facets of cane management and facilitate how individuals, enterprises and companies across the value chain incorporate these management practises into their mainstream activities. Building social capital through targeted extension, improving skills and providing an industry-wide knowledge base are all essential. By cultivating a solid management practice knowledge base, the sugarcane industry can respond to the strongly emerging need to bring together new technologies based on geographic information systems (GIS) data sets, through AgDat, in ways that will allow the industry to collectively position its future in an economically and environmentally, productive and sustainable context.

Last but not least, investment in science dedicated/related to production systems and theory will continue to bring improvements in our understanding of these areas within the next decade. R&D strategies cannot by nature be complete and will have a limited time frame of relevance – in the case of much of the material in this document, possibly less than five years. Continual improvement in integrated farming systems through targeted research is essential to maintain a cutting edge in sustainable sugarcane production. At the same time, a close understanding of developments in all facets of cane management systems along with links to the wider industry will be essential for our sugarcane industry to implement strategic responses to cane management.

ABCD management framework

The following section has been taken straight from the Water Quality Improvement Plan: final report for Mackay Whitsunday region (Drewry, J., Higham, W., Mitchell, C. 2008), with the only alterations being those to remove most references to those practices not relevant to cane, along with the editing required to maintain readability.

This document presents cane management practices to achieve catchment and region-wide reductions off-farm pollution of waterways. (An evaluation of on-farm establishment and total implementation costs for farm management practices in the region is presented in the Water Quality Improvement Plan. Full details of on-farm costs are presented in the accompanying reports to that plan.)

This document presents:

- An 'ABCD' framework to classify management practices;
- Soil, nutrient, pesticide, harvesting and water management practices for cane to reduce potential of farm pollutant loads;
- Business/finance and workplace health and safety management practices for cane producers.

Herbicides are identified as a key pollutant of concern. Management practices are included for 'pesticide' as pesticide is a general classification which includes herbicides, fungicides, rodenticides, insecticides etc for which the same management principles apply.

Development of the ABCD framework for practices

The identification and validation of cane practices that can improve water quality was a major focus throughout the development of the WQIP. A series of literature reviews and formal consultation processes with industry organisations and stakeholders, technical experts and land managers were used to identify and quantify the range of management practices that can be adopted.

The focus was on cane management practices used in the Mackay Whitsunday region.

A pivotal stage in the WQIP process was the development of the 'ABCD' classification. The original ABCD land condition scoring framework was developed by Department of Primary Industries and Fisheries (DPI&F) to assess and rate grazing land condition. It is currently used in grazing industry workshops in Queensland (e.g. Chilcott *et al* 2007).

The ABCD framework was designed to facilitate communication about the different levels or standards of management practice (as opposed to resource condition) within an industry for different water quality parameters (i.e. soil management, nutrient management and pesticide management). The ABCD framework provides a definition and a scale of improvement from 'old' to 'cutting-edge' practices. The framework is a planning tool, not an extension tool. The ABCD framework is determined by criteria relating to:

- The resource condition achieved by adopting the level of practice in the short, medium and long terms ('A' level practice should produce 'A' level resource condition etc);
- The acceptability of the level of practice to all levels of the community; and
- Achieving wide adoption of the level of practice in the short, medium and long terms, based on demonstrated stakeholder-endorsed cost effectiveness.

The framework was used to communicate different levels of management practice to water quality researchers, social scientists, economists, industry research and extension organisations, and land managers. The framework provides the common reference point and requires many different people to work together to identify the most cost effective public and private investments in sustainable land management, by defining:

- The level of water quality improvement that can be achieved through improved management practices;

- The social and economic costs and benefits of adopting improved management practices;
- The level of adoption of management practices required to achieve the water quality targets;
- The type and scope of market based incentives (MBIs) required to achieve water quality targets; and
- The type and scope of actions (other than MBIs) required to achieve water quality targets.

For the ABCD framework it is important to specify the current resource condition, resource condition targets, and timeframes, as well as the year of reference for the level of classification. The ABCD framework classification descriptions for each industry are incomplete. More work is required to refine the ABCD classifications such as:

- Tailor the wording of the classification descriptions to match industry terminology;
- Define the resource condition indicators;
- Validate the link between the resource condition indicators and the level of practice; and
- Define actions required to move from one level of management to another level of management, e.g. improving D resource condition for grazing land.

Further validation of the practicability of implementation, and the productivity and economics of cutting-edge practices is required. Over time, changes in knowledge, technology, costs and market conditions will see cutting-edge 'A' level practices eventually become 'B' level practices and if the practices are widely adopted by industry, they will become the common 'C' level practices for the ABCD framework in the WQIP. The framework classification descriptions are shown in Table 1. Considerable effort was undertaken to consult with cane industry partners when developing the ABCD framework.

The ABCD framework emphasises the importance of detailed resource planning and record keeping to achieving improved resource management, rather than a single technology or individual practice. In agriculture, the detailed resource plan may be achieved by a paddock scale, precision agriculture plan, prepared by engaging a consultant to help or through completion of an industry endorsed Farm Management System (FMS) process. The precision agriculture plan should incorporate risk management (at paddock, farm and wider scales) and continuous improvement. It should also identify a suite of individual practices to be implemented in an annual action plan with milestones and timeframes. In doing this the precision agriculture plan allows demonstration of meeting a general environmental duty (GED), duty of care and eligibility for market based incentives.

There are opportunities using the ABCD framework to develop further systems-based approaches. Although soil, nutrient and pesticide management practices have been the focus of the WQIP, irrigation and stormwater management practices could be incorporated in the future. The cane industry has used the ABCD framework to define different levels of financial management and workplace health and safety (included in this document). If this approach is pursued the resource management components could be aligned with business management components making a consistent FMS framework.

Drewry, J.; Higham, W.; Mitchell, C. 2008. Water quality improvement plan. Final report. Mackay Whitsunday Natural Resource Management Group.

Table 1 Management classes and definition for ABCD framework for management practices

Class	Description of practice	Farm management plan	Community and industry standard	Effect on resource condition	Effect on profitability
A	Cutting-edge practices that require further validation of environmental, social and economic costs/benefits.	Yes, develops and tests innovative technology.	When validated is an acceptable practice for the long term. (May not be universally endorsed as feasible by industry and community).	When validated, practice likely to achieve long term resource condition goals if widely adopted.	When validated, improves profitability in the medium to long term. (May reduce profitability during the transition).
B	Currently promoted practices often referred to as 'Best Management Practices'.	Yes, and utilises common technology.	Acceptable practice for the medium term.	Practice likely to achieve medium term resource condition goals if widely adopted.	Improves profitability in the short to medium term.
C	Common practices. Often referred to as 'Code of Practice'.	Basic.	Acceptable practice today but may not be acceptable in medium term.	Practice unlikely to achieve acceptable resource condition goals if widely adopted.	Decline of profitability in the medium to long term.
D	Practices that are superseded or unacceptable by industry and community standards.	None.	Superseded or unacceptable practice today.	Practice likely to degrade resource condition if widely adopted.	Decline of profitability in the short to medium term.

Drewry, J.; Higham, W.; Mitchell, C. 2008. Water quality improvement plan. Final report. Mackay Whitsunday Natural Resource Management Group.

Table 2 Processes used in the identification and development of management practices in the WQIP.

Stage of process	Cane
Identification of management practices that may improve water quality	Literature review and consultation with state wide cane (including BSES Ltd, CANEGROWERS, Department of Natural Resources and Water (NRW), CSIRO), technical experts in October to November 2006.
Quantification of water quality improvement from management practices	Literature review of cane management practices NRW implemented a rainfall simulator research trial with nutrient and residual herbicide application treatments.
Development of ABCD Framework	Developed by Will Higham (MWNRM), Phil Trendell (BSES Ltd), John Rolfe (Central Queensland University (CQU), Jill Windle (CQU) and Judith Wake (CQU).
Validation of ABCD Framework	Draft reviewed by CANEGROWERS Proserpine and CANEGROWERS Mackay.
Social and economic analysis of ABCD adoption	Sustainable Landscapes Program incentive developed in consultation with CANEGROWERS and BSES Ltd. Cost of adoption estimated by John Drewry and Will Higham based on Sustainable Landscapes projects. Mackay and Proserpine canegrowers participated in Social and Economic workshop facilitated by CQU. DPI&F modelling and analysis of cost and benefits of adopting cane best management practices (Rod Strahan, DPI&F).
Current and target ABCD adoption rates	Estimated by Will Higham and John Drewry based on Mackay and Proserpine canegrowers that participated in Social and Economic workshop facilitated by CQU.

Drewry, J.; Higham, W.; Mitchell, C. 2008. Water quality improvement plan. Final report. Mackay Whitsunday Natural Resource Management Group.

Soil management practices for cane are summarised in Table 3. Current practice is likely to be a mix of all the practices in the table, although the green cane trash blanket practice is likely to be adopted by about 80% of farmers in this region.

As cane soil management progresses from D to A class there is increasing precision in management of cultivation and controlled

traffic to minimise impacts of compaction and erosion. Controlled traffic, for example, is nonexistent in D and C class management, while B class includes controlled traffic, and A class includes controlled traffic with GPS guidance of all operations. D and C class includes cultivated plant cane while B and A class includes strategic or zonal tillage for plant cane.

Table 3 Soil management practices for cane classified in the ABCD framework

D class Cane soil management	C class Cane soil management
<p>Description:</p> <ol style="list-style-type: none"> 1. Cultivated bare fallow or ‘plough out and replant’ 2. Fully cultivated plant cane 3. Cultivated ratoons 4. Records kept in head <p>Planning and record keeping:</p> <ol style="list-style-type: none"> 1. None <p>Machinery:</p> <ol style="list-style-type: none"> 1. Standard equipment 	<p>Description:</p> <ol style="list-style-type: none"> 1. Minimum till bare fallow with chemical weed control 2. Reduced cultivation of plant cane replaced by strategic chemical weed control 3. Strategic ripping of wheel tracks in ratoons 4. Records kept in daily diary <p>Planning and record keeping:</p> <ol style="list-style-type: none"> 1. Keep daily diary <p>Machinery:</p> <ol style="list-style-type: none"> 1. Standard equipment
B class Cane soil management	A class Cane soil management
<p>Description:</p> <ol style="list-style-type: none"> 1. Controlled traffic permanent beds maintained by zonal tillage 2. Global positioning system (GPS) guidance on planting equipment and cane harvesting machinery 3. Automated base cutter height 4. Rotational crop management to harvest 5. Strategic or zonal tillage of fallow crops and plant cane 6. Permanent bed widths determined by harvester wheel centre measurements 7. Headlands, drains and waterways managed as filter strips 8. Records kept in paddock journal <p>Planning and record keeping:</p> <ol style="list-style-type: none"> 1. Identify soil types and productivity zones using existing maps, digitised mill data and electro magnetic technology 2. GPS technology for spatially identifying problem areas 3. Develop computer skills enabling access to digital mill data and geographic information system (GIS) software 4. Develop basic ‘soil management plan’ utilising soil mapping 5. Adjust soil management practices based on research results <p>Machinery:</p> <ol style="list-style-type: none"> 1. Standard wheel spacing based on harvester wheel centre measurements 2. GPS guidance on bed formers, planting equipment and cane harvester 3. Automated base cutter height on harvester 4. Yield monitors fitted to harvesters 	<p>Description:</p> <ol style="list-style-type: none"> 1. As for B class 2. Controlled traffic permanent beds with GPS guidance of planting, zonal tillage, harvesting and haulout machinery 3. Site specific application of ameliorants and mill by-products 4. Develop variable rate application program <p>Planning and record keeping:</p> <ol style="list-style-type: none"> 1. Spatially identified soil types and management zones across blocks and farms utilising remote sensing and electro magnetic (EM) soil mapping technology 2. Integrate a GPS based soil management plan 3. Geo-referenced spatial data captured in GIS software systems 4. Keep records in computer database/paddock journal <p>Machinery:</p> <ol style="list-style-type: none"> 1. Standard wheel spacing on all equipment 2. GPS auto guidance systems on bed-formers, planting equipment and harvesting machinery including haulouts 3. Automated base cutter height fitted to harvester 4. Yield monitors fitted to harvester

Nutrient management practices are summarised in Table 4. Current practice is likely to be a mix of largely old BSES Ltd nutrient application rates, sometimes known as Calcino rates, (C and D class practices), with adoption being encouraged for new BSES Ltd application rates (commonly known as Schroeder rates) B and A class practices, namely a result of research over recent years. Further information is presented in Drewry *et al.* (2008b).

As cane nutrient management progresses from D to A class there is increasing precision in management of nutrient inputs to optimise the supply of nutrients to the plant. For example, with D and C class there are only one or two nutrient rates for the farm, while for B class management nutrient rates may vary between blocks. In A class nutrient rates may vary within blocks.

Table 4 Nutrient management practices for cane classified in the ABCD framework

D class Cane nutrient management	C class Cane nutrient management
<p>Description:</p> <ol style="list-style-type: none"> 1. One rate for whole farm 2. Application rates based on historic application rates or rules of thumb 3. Records kept in head <p>Planning and record keeping:</p> <ol style="list-style-type: none"> 1. None <p>Machinery:</p> <ol style="list-style-type: none"> 1. Surface or sub-surface fertiliser box 	<p>Description:</p> <ol style="list-style-type: none"> 1. Some soil testing 2. One or two rates for the whole farm 3. Application based on old industry recommendations 4. Basic record keeping <p>Planning and record keeping:</p> <ol style="list-style-type: none"> 1. Conduct soil tests 2. Develop basic nutrition management plan 3. Keep daily diary <p>Machinery:</p> <ol style="list-style-type: none"> 1. Surface or sub-surface fertiliser box, or surface applied and irrigated into soil
B class Cane nutrient management	A class Cane nutrient management
<p>Description:</p> <ol style="list-style-type: none"> 1. Soil test fallow blocks each year 2. Variable rate between blocks 3. Application rates based on latest industry recommendations taking mill by-products and fallow history into account 4. Timing nutrient applications with respect to crop stage, irrigation and rainfall 5. Records kept in paddock journal <p>Planning and record keeping:</p> <ol style="list-style-type: none"> 1. Identify soil types/productivity zones for each block 2. Develop nutrient management plan using yield, soil mapping and latest industry recommendations 3. Change fertiliser rates between blocks 4. Knowledge of latest NM issues and recommendations 5. Conduct soil tests (and leaf analysis if required) 6. Keep records (including yield) in paddock journal 7. Adjust nutrient rates for next year if required <p>Machinery:</p> <ol style="list-style-type: none"> 1. Granular: Sub-surface fertiliser box with rate control 	<p>Description:</p> <ol style="list-style-type: none"> 1. Soil sample specific areas within block 2. Variable rate within blocks 3. Application rates based on specialist interpretation of the latest industry recommendations 4-5. Same as B class 6. Records kept in computer database /paddock journal <p>Planning and record keeping:</p> <ol style="list-style-type: none"> 1. Identify soil types/productivity zones within each block using GPS yield and soil mapping 2. Develop GPS based Nutrient Management Plan using yield, soil mapping and specialist interpretation of latest industry recommendations 3. Apply variable fertiliser rates within blocks 4 – 5. Same as B class 6. Keep records in computer database /paddock journal 7. Same as B class 8. Some basic/periodic water quality monitoring 9. Near-infrared (NIR) data used to adjust nutrient rates (future) <p>Machinery:</p> <ol style="list-style-type: none"> 1. Sub-surface variable rate fertiliser box with remote/ automatic rate control and GPS guidance

Pesticide management practices for cane are summarised in Table 5. The term pesticide is used in this section as it is a general classification including herbicides, fungicides, rodenticides, and insecticides for which similar

management principles apply.

As cane pesticide management progresses from D to A class there is increasing precision in management of pesticide inputs.

Table 5 Pesticide management practices for cane classified in the ABCD framework

D class Cane pesticide management	C class Cane pesticide management
<p>Description:</p> <ol style="list-style-type: none"> One herbicide strategy for the whole farm based on historic application rates or rules of thumb Often uses maximum label rate residual and knockdown products, irrespective of weed pressure. Records kept in head <p>Planning and record keeping:</p> <ol style="list-style-type: none"> None <p>Machinery:</p> <ol style="list-style-type: none"> Standard spray rig both high and low clearance 	<p>Description:</p> <ol style="list-style-type: none"> One or two herbicide strategies for the whole farm Same as class D uses residual and /or knockdowns at rates appropriate to weed pressure. Records kept in daily diary Keep material safety data sheets (MSDS) <p>Planning and record keeping:</p> <ol style="list-style-type: none"> Develop basic herbicide management plan Keep daily diary <p>Machinery:</p> <ol style="list-style-type: none"> Same as D class
B class Cane pesticide management STRATEGIC PRECISION	A class Cane pesticide management LATEST TECHNOLOGY FOR STRATEGIC PRECISION
<p>Description:</p> <ol style="list-style-type: none"> Implementation of new application technology for improved placement and timing to improve application efficiency, accuracy and to extend the window of opportunity Knockdown herbicides replace residual herbicides where practical (residual herbicides only used where weed pressure demands it). Use only non-mobile pre-emergents at correct timing and correct label rate. Efficient use of pre-emergents will lower overall chemical application. Avoid resistance issues. Enable correct application timing in wet weather Timing pesticide applications with respect to crop stage irrigation and rainfall Variable herbicide strategies between blocks A focus on good weed control in fallow and plant cane to ensure minimal herbicide in ratoon stages Records kept in paddock journal Storage – lockable with bunding & emergency washdown <p>Planning and record keeping:</p> <ol style="list-style-type: none"> Identify – weed types/pressure, soil types and productivity zones for each block Develop herbicide management plan using weed pressure, soil types, crop stage and yield mapping. Formulate best practice pre-emergent management plan avoiding the use of mobile pre-emergents (e.g. Diuron and Atrazine) Change herbicide strategy between blocks Attend herbicide management course Attend spray nozzle technology workshop Monitor weed pressure Keep records (including yield) in paddock journal, including wind speed, direction, time of spraying, herbicide and rate. Adjust herbicide strategy for next year if required <p>Machinery:</p> <ol style="list-style-type: none"> Hooded sprayers, more accurate nozzles (matched to job) and high clearance tractors with manual rate control <p>Subsidies: Hooded sprayers, dual tank setups, correct nozzles Development of herbicide management plans (consultant) Spray nozzle technology workshop Data analysis and plan review (consultant)</p>	<p>Description:</p> <ol style="list-style-type: none"> 1–3. Same as B class Variable herbicide strategies within blocks. Records kept in computer database /paddock journal <p>Planning and record keeping:</p> <ol style="list-style-type: none"> Identify – Weed types/pressure, soil types and productivity zones within each block using GPS yield and soil mapping. Weed survey of blocks Develop GPS based herbicide management plan using weed pressure, soil types, crop stage and yield mapping Apply variable herbicide strategies within blocks. e.g. Weed pressure on row ends Patches of weeds/vines Turning on/off 4 – 5. Same as B class Keep records in computer database /paddock journal automated record keeping (e.g. variable rate screen) Same as B class Adjust herbicide strategy for whole of crop cycle. <p>Machinery:</p> <ol style="list-style-type: none"> Hooded sprayers, more accurate nozzles (matched to job) and high clearance tractors with remote/ automatic rate control and GPS guidance <p>Subsidies: Variable rate screen (mapped paddock) Dual tank setups Spray nozzle technology workshop</p>

In March 2008, SYDJV and the FutureCane team identified harvesting as one of two major impediments to the adoption of the 'improved' farming system. Harvesting contractors must be able to directly access incentive money to facilitate adoption of technical equipment, machinery modifications and operating practices which are necessary to enable

growers to change practices and extract the full benefits of the 'improved farming system.'

Harvesting management practices for cane are summarised in Table 6.

As cane harvesting management progresses from D to A class there is increasing precision in management of harvesting practices.

Table 6 Harvesting management practices for cane classified in the ABCD framework

D class Cane harvesting management	C class Cane harvesting management
<p>Planning and record keeping:</p> <ol style="list-style-type: none"> 1. Records kept in head 2. Minimal communication between grower and contractor 3. No reference to mill cane quality reports <p>Machinery, capital works actions:</p> <ol style="list-style-type: none"> 1. Standard harvester with no means of adjustment to meet harvesting best practice 2. Inefficient farm layout: short rows and no ability to harvest through blocks; narrow and rough headlands common 	<p>Planning and record keeping:</p> <ol style="list-style-type: none"> 1. Verbal harvest plan agreement between grower and contractor pre-crushing 2. Some reference by grower to mill cane quality reports but no change in practices as a result <p>Machinery, capital works actions:</p> <ol style="list-style-type: none"> 1. Some improved modifications to harvester 2. Harvesting through blocks is practiced 3. Narrow and rough headlands common
B class Cane harvesting management	A class Cane harvesting management
<p>Planning and record keeping:</p> <ol style="list-style-type: none"> 1. Development of harvest management plan between farmer and contractor (includes written contract and differential price agreement)#1 2. Harvesting practice recording/reporting#2 3. Training/knowledge improvement activities linked to improved harvest management (IFS training workshop)#3 <p>Capital works/landscape actions:</p> <ol style="list-style-type: none"> 1. Harvester and haul out*1 GPS guidance equipment 2. Installation of GPS tracking devices onto harvesters 3. Automatic base cutter height control 4. Elevator extensions, or elevator modification (e.g. Louisiana extension) 5. Harvester front modifications to accommodate wide rows (controlled traffic) 6. Widening of and smoothing of grassed headlands*2 7. Undertaking regular cane loss assessments (infield and delivery points) 8. Roller train optimisation and correct matching to choppers*3 	<p>Planning and record keeping:</p> <ol style="list-style-type: none"> 1. Include harvesting component in Farm Economic Analysis Tool (FEAT) model Harvesting Economic Analysis Tool (HEAT)#4 2. Harvesting practice electronic recording 3. Produce harvester productivity reports and yield maps at a block level <p>Capital works/landscape actions:</p> <ol style="list-style-type: none"> 1. Haul out rear wheel steering modification*4 2. Electronic consignment of bins*5 3. Automatic primary extractor fan speed control*6

see Appendix one

* see Appendix one

Water management practices for cane are summarised in Table 7.

As cane water management progresses from D to A class there is increasing precision in management of water inputs.

Table 7 Water management practices for cane classified in the ABCD framework

D class Cane water management	C class Cane water management
<p>Description:</p> <ol style="list-style-type: none"> 1. No scheduling tools utilized 2. Irrigations based on gut feel <p>Irrigation application:</p> <ol style="list-style-type: none"> 1. Application amount unknown 2. No consideration of matching nozzles to pump <p>Planning and record keeping:</p> <ol style="list-style-type: none"> 1. No recording or planning <p>Drainage:</p> <ol style="list-style-type: none"> 1. Basic drainage considered in original farm layout 	<p>Description:</p> <ol style="list-style-type: none"> 1. Visual checks – experience 2. How long it takes to get around 3. Prioritise crop cycle, e.g. Plant cane, 1st ratoon over 5th ratoon 4. Water availability 5. Costs – energy (e.g. weekend tariffs) 6. General knowledge of local rainfall history <p>Irrigation application:</p> <ol style="list-style-type: none"> 1. Based on experience 2. Amount often unknown, loosely determined by pump meter reading/time/ha 3. No efficiency checks conducted on equipment 4. May change nozzles to match pump size and pressure 5. Some consideration due to soil type – mainly textural 6. Consideration to land formation and slope <p>Planning and record keeping:</p> <ol style="list-style-type: none"> 1. Records kept in head 2. Water meter readings recorded in pocket diary 3. Basic understanding of soil moisture characteristics – based on texture rather than scientifically determined PAWC 4. Planning based on verification of meter readings, not measured system outputs 5. Planning based on productivity potential, e.g. favour plant cane, disregard rubbish cane 6. Planning based on amount of effort required, e.g. It may be more efficient to water over three nights, but more labour intensive <p>Drainage:</p> <ol style="list-style-type: none"> 1. Existing farm layout and infrastructure considers drainage – laser levelling
B class Cane water management	A class Cane water management
<p>Description:</p> <ol style="list-style-type: none"> 1. Scheduling tools utilized manually 2. Tools broadly used, e.g. to main soil type or limiting soil type 3. Climate forecasting models used 4. Irrigation scheduling plan for each crop year <p>Irrigation application:</p> <ol style="list-style-type: none"> 1. System efficiency checks conducted annually 2. Application amount determined through management plan – an informed decision 3. Water tests conducted where an impact on application amount is applicable, e.g. EC and infiltration/holding capacity <p>Planning and record keeping:</p> <ol style="list-style-type: none"> 1. Water management plan encompassing: soils; scheduling; efficiency – system check; allocation; farm layout and infrastructure; economics 2. Comprehensive recording system: paddock journal as example; recording format is able to be collated and analysed 3. Building knowledge of soil and water interactions: industry training; soil mapping <p>Drainage:</p> <ol style="list-style-type: none"> 1. Storm water storages / sediment traps 2. Water testing incorporated, mainly for on-farm reuse 	<p>Description:</p> <ol style="list-style-type: none"> 1. Scheduling tools utilized with some level of automation 2. Scheduling based on block or management units 3. Scheduling based on specific soil types <p>Irrigation application:</p> <ol style="list-style-type: none"> 1. As for B class 2. Application amounts matched to soils with a high degree of precision, possibly using EM mapping or equivalent 3. Software such as TravGun, SIRMOD, IPART used <p>Planning and record keeping:</p> <ol style="list-style-type: none"> 1. Comprehensive records kept using spatial software 2. Comprehensive knowledge of soil and water interactions: Certificate in irrigation management 3. As for B class <p>Drainage:</p> <ol style="list-style-type: none"> 1. Comprehensive drainage plan considering all farm drainage points 2. As for B class

Workplace health and safety management practices for cane are summarised in Table 8. As cane workplace health and safety

management progresses from D to A class there is increasing precision in management of workplace health and safety processes.

Table 8 Workplace health and safety management practices for cane classified in the ABCD framework

D class Cane WH&S management	C class Cane WH&S management
<p>Planning and record keeping:</p> <ol style="list-style-type: none"> 1. Little or no training provided 2. No policies 3. Minimal inductions 4. Minimum understanding of WH&S 5. No record keeping 6. Little or no hazard identification and risk management 7. Lack of personal protective equipment (PPE) 	<p>Planning and record keeping:</p> <ol style="list-style-type: none"> 1. Basic understanding of PH&S 2. Conducts mental risk assessments 3. Provides verbal warning and instructions 4. Provides basic inductions 5. No formal records kept 6. Basic PPE 7. Basic emergency procedures
B class Cane WH&S management	A class Cane WH&S management
<p>Planning and record keeping:</p> <ol style="list-style-type: none"> 1. Generic WH&S policies 2. Written risk management procedures 3. Basic written warnings and policies 4. Provides relevant safe equipment 5. Basic record keeping 6. Basic review of policies and procedures 7. Basic written inductions 8. Feed back 9. Emergency procedures (First Aid) 10. Sign off on induction, etc by employee/s 	<p>Planning and record keeping:</p> <ol style="list-style-type: none"> 1. Formal Inductions 2. Training in risk management/assessment 3. Hazard Identification 4. Formal policies/procedures 5. Follow up and review of policies and procedures 6. Detailed record keeping 7. Detailed knowledge of WH&S policies 8. Detailed emergency procedures 9. As for point 10 B class

Business/finance management practices for cane are summarised in Table 9.

As cane business/finance management

progresses from D to A class there is increasing precision in management of business/finance processes.

Table 9 Business/financial management practices for cane classified in the ABCD framework

D class Cane business/financial management	C class Cane business/financial management
<p>Description:</p> <ol style="list-style-type: none"> 1. Ensure all financial information is provided to an accountant for compilation 2. No formal budgets are written 3. No formal business plans are written 4. Marketing is left to the mill and Queensland Sugar Limited (QSL) <p>Financial records:</p> <ol style="list-style-type: none"> 1. Invoices and receipts kept together 2. Fuel docket kept separately 3. Wages documented 4. Basic financial analysis from bank statements 5. Discuss with bank manager when necessary <p>Budgets:</p> <ol style="list-style-type: none"> 1. Basic unwritten 2. Basic opportunity analysis 3. Basic GM cost analysis <p>Business plans:</p> <ol style="list-style-type: none"> 1. Basic planning 2. No succession planning 3. No benchmarking <p>Marketing:</p> <ol style="list-style-type: none"> 1. No marketing strategy – left to the mill and/or QSL 	<p>Description:</p> <ol style="list-style-type: none"> 1. BAS completed quarterly on computer system then (maybe) checked by an accountant 2. Budgets and economic analysis completed 3. Skills training identified and hand written paddock journals 4. Awareness of mill pricing system <p>Financial records:</p> <ol style="list-style-type: none"> 1. Recording payments/receipts in a computerised cashbook 2. Books of prime entry 3. Quarterly entry of data (BAS; fuel rebate) 4. Financial analysis completed & discuss with accountant <p>Budgets:</p> <ol style="list-style-type: none"> 1. Annual operational and capital budgets developed 2. Year on year comparison 3. Economic analysis of whole farm gross margin 4. Annual farm budget compared to actuals 5. Basic machinery costs analysed 6. Opportunity cost analysis when necessary <p>Business plans:</p> <ol style="list-style-type: none"> 1. No formal annual strategic plan 2. No succession planning 3. Basic benchmarking - accountant developed using their client base 4. Skills training identified 5. Written paddock journals completed <p>Marketing:</p> <ol style="list-style-type: none"> 1. No formal marketing strategy 2. Aware of mill pricing system, minimal usage
B class Cane business/financial management	A class Cane business/financial management
<p>Description:</p> <ol style="list-style-type: none"> 1. BAS completed quarterly on computer system 2. Budgets and cost centre analysis completed monthly 3. Strategic business planning undertaken and computerised 4. Formal marketing strategy <p>Financial records:</p> <ol style="list-style-type: none"> 1. Detailed monthly entries into computerised recording system using basic cost centres (MYOB etc) 2. Monthly reporting and financial analysis 3. Update machinery and other asset values plus liabilities to develop actual statement of position annually 4. As C class 	<p>Description:</p> <ol style="list-style-type: none"> 1. Record changes to asset values annually 2. Detailed ratio analysis 3. Management Plans updated regularly 4. Economic Analysis of spatial/paddock gross margins 5. Marketing own product <p>Financial records:</p> <ol style="list-style-type: none"> 1. Detailed entry using comprehensive cost centres to assist in depth analysis 2. Monthly computerised entry and reports 3. Development and analysis of changes in statement of position at least annually 4. Financial and performance analysis discussed with competent business advisor/consultant (this maybe your accountant)

Budgets:

1. All budgets computerised living documents personally developed and reviewed monthly
2. Cost centre specific budgeting
4. Detailed machinery costing computerised and analysed at least annually
5. As C class

Business plans:

1. Strategic business plan developed
2. Succession plan written
3. Benchmarking
4. Skills training plan
5. Land and water management plan completed (with water quality information continuously updated)
6. Economic analysis
7. Paddock journals computerised and added into Nutrient; soil and chemical management plans

Marketing:

1. Formal marketing strategy
2. Utilisation of mill (or other) pricing system

Workshops:

1. FEAT workshop
2. Succession planning workshop
3. Land and water management plan workshop
4. Farm Productivity Improvement Plan (FPIP)
5. Business planning workshop

Budgets:

1. Detailed ratio analysis (e.g. use of FEAT or similar tool)
2. Benchmarking/accountants group and proactive farmer group
3. Cost centre analysis
4. Monthly budget comparison to cost centres. Various partial budgets for economic analysis
5. As B class

Business plans:

1. Detailed succession plan regularly updated and implemented
2. Strategic plan and risk analysis updated annually
3. Land & water management plan updated quarterly
4. Skills Training regularly for management and staff
5. Economic analysis of spatial/paddock gross margins
6. Sensitivity analysis (risk)
7. As B class

Marketing:

1. Controlling marketing of own product
2. Futures / hedging

Appendix one

#1. Harvest plan formalises communication between two parties and includes: hazard mapping, block harvesting sequence (includes cutting through several blocks, strategies to minimise the harvesting of wet blocks and take precautions when harvesting grub-damaged or stool-tipped blocks), efficient row lengths (includes escape routes to improve harvest efficiency and reduce unnecessary infield traffic), matching hill-up/bed shape to harvester. A formal harvesting contract is also essential to bind both parties and offer stability for the contractor. Lack of contracts means harvesting-price undercutting by contractors who do not have a good understanding of their costs. Ultimately when contractors are under financial pressure the job suffers leading to more cane loss, soil intake and stool damage. Monetary incentives could be applied for by the harvesting group but only if individual farmers have contracts with the harvester. Cane loss can directly affect quality of runoff water. Activities which can improve the profitability of contractor and farmer mean they are in a better position to adopt environmentally sustainable practices.

#2. Harvesting contractors must record machine performance parameters (e.g. engine hours, elevator hours, down-time, fuel usage etc.) and farm/block details to accurately calculate field efficiency and the cost of harvesting. By knowing this information they can inform farmers of the true costs of harvesting and also highlight the cost efficiency of controlled traffic. A price scale linked to pour rate plainly shows blocks which are more efficient to cut than others. Currently a small percentage use a manual recording system but the development of a digital system would be beneficial. Mackay Sugar is developing this capability and currently offers some performance feedback on machines equipped with GPS and yield monitors. Incentives to fully develop this system would be ideal. Yield monitors on harvesters enable production of yield maps which can be overlaid on soils maps (including EM maps) and can be used in combination

with chemical fertility data to enable variable rate application of fertiliser and ameliorants where applicable. These applications will be developed as part of the AgDat project.

#3. Contractors have been neglected to a large extent in extension campaigns to promote the 'improved' farming system (IFS). They need targeting with information demonstrating that IFS can improve their profitability. A BSES harvesting Best Management Practice Workshop was developed and rolled-out with harvest crews. This material can be modified to place greater emphasis on the interaction between harvesting practices and the IFS.

#4. FEAT (Farm Economic Analysis Tool) is useful for enabling a grower to compare the financial impact of converting from old to the 'improved' farming system (i.e. controlled traffic, legume rotation and minimum tillage). The inclusion of a harvesting cost component in this model (HEAT- Harvesting economic analysis tool) will assist the contractors to compare machinery modifications and operation changes designed to facilitate the adoption and realise the full benefits of the 'improved' farming system. The YDJV and FutureCane team have identified harvesting as one of two major impediments to the adoption of the 'improved' farming system. Often contractors are asked to harvest controlled traffic, dual rows or preformed beds and are asked to 'foot-the-bills' for modifications or operational changes but are provided with little or no evidence that their investment will be profitable. There are many examples of where growers are keen to adopt changes but harvesting contractors will NOT cooperate.

*1. Haul units need GPS guidance (or some other cheaper technology linked to harvester GPS) to prevent wander onto stool/grow zone otherwise the controlled traffic system will be compromised, its benefits not realised and farmers will question its validity.

*2. Narrow headlands cause cane transporters to run on the stool at the entry and exit of paddocks. This causes compaction and

prevents even controlled traffic rows from realising their productive potential. A wider grassed headland provides a better filter strip. Rough headlands slow haul speed and the harvesting operation. This causes speeding up of the operation in the paddock leading to more stool damage, cane losses and compaction which reduce profitability and sustainability of farmer and ultimately the contractor. Rough headlands also deteriorate quicker and are more prone to wash and erosion.

*3. Roller train optimisation and correct match to choppers - Tip speeds of all rollers should be synchronised with exception of but lifter which will be slower. Relationship between roller tip speed and chopper tip speed requires fine-tuning by individual operators. This will result in better feed of cane into the front (less cane pickup loss) a more even feed through the rollers and choppers (less juice loss) and extractors dealing with fewer gluts of cane/trash (less extractor cane losses).

*4. Transporters turning into the paddock tend to run on the stool for a significant distance before centring on interspace. Investigations into rear-wheel steering in Mackay have alleviated this problem to a large extent.

*5. Electronic bin consignment will improve the accuracy of productivity data and enable better matching of inputs like fertiliser with crop performance. Currently mis-consignment is a major issue for most mills.

*6. Automated fan speed control would reduce the extractor fan revs to a lower speed when cane throughput is at a minimum level thus avoiding loss of cane onto the ground especially at the end of rows.

Appendix two

Group members:

Soil

John Hughes (DPI&F)
Jon Graftdyk (MWNRM)
Tony Crowley (Contractor)
Lee Blackburn (Farmer/Contractor)
John Simpson (Farmer)
Charlie Deguara (Farmer)
Rodney Lamb (Farmer)
John Pastega (Farmer)

Nutrient

Barry Salter (BSES)
Phil Morris (BSES)
Malcolm Warren (SSP)
Rob Sluggett (PCPS)
Phil Trendell (BSES/MWNRM)
Ross Williams (Farmer)
Rob Keating (Farmer)
Tony Bugeja (Farmer)
Glenn Clark (Farmer)

Pesticide

Allan Royal (MAPS)
Andrew Guy (Farmer)
Phil Ross (MAPS)
Will Higham (MWNRM)
Chris Aylward (PCPS)
Chris Blackburn (Farmer/contractor)
Lou Raiteri (Farmer)

Harvesting

John Agnew (BSES)
John Markley (Mackay Sugar)
Steve Young (Farmer/contractor)
Steve Dinsdale (Contractor)
Kevin Borg (Farmer/contractor)
Joe Muscat (Farmer/harvester opr/BSES)
Sue Rowlinson (PCPS)
Tony Jeppersen (Farmer)
Gerry Deguara (Farmer)
Ron Gurnett (Farmer)

Water

Kalya Abbey (BSES) (resigned)
Rob Cocco (MWNRM)
Peter Sutherland (SSP)
Brad Hussey (BSES)

Alison Hambleton (NRW)
Lawrence Bugeja (Farmer)
Steve Young (Farmer/contractor)
Lindsay Williams (Farmer)
Wayne Simpson (Farmer)
Phil Morris (BSES)

Workplace Health and Safety

Alan Graham (Canegrowers)
Frank Frazer (Dept of Industrial Relations)
Lisa Keating (Farmer)
Frank Perna (Farmer)
Sergio Berardi (Farmer)

Business/Finance

Burn Ashburner (MAPS)
John Eden (Canegrowers)
Joy Guy (Farmer)
Richard Lewis (DPI&F)
Neil Cliffe (DPI&F)
Andrew Cappello (Farmer)
Warren Watts (Farmer)
Eddie Westcott (Farmer)
Tony Hinschen (Farmer)

PMSI Officer

Raylene Hansen (DPI&F)

DPI&F	13 25 23
Reef Catchments MWNRM	4968 4200
BSES	4963 6800
MAPS	4954 5300
PCPS	4956 2875
NRW	4967 0820
SSP	4945 0516

Bibliography

Drewry, J.; Higham, W.; Mitchell, C. (2008).
Water quality improvement plan. Final
report. Mackay Whitsunday Natural Resource
Management Group.