The Mackay Whitsunday Isaac Region Sustainable Horticulture Guide provides relevant information and tools to assist producers in achieving sustainable management of their land, whilst maintaining or enhancing farm efficiency and productivity. It is designed to be a resource for finding information rather than a comprehensive manual on horticulture management.

This guide has been written for horticulture producers in the Mackay Whitsunday Isaac region. It links to the Mackay Whitsunday ABCD Management Practice Framework for Horticulture: 2015 Update (Reef Catchments, 2015).

'A' Class or innovative practices from the ABCD Framework are identified throughout this document.

The Mackay Whitsunday region includes the catchments of the Pioneer, O'Connell and Proserpine River systems and covers an area of approximately 9,000 square kilometres. The climate is subtropical to tropical with a distinctive wet season. The average annual rainfall is 1,300 to 2,000 millimetres and over 50 percent of this falls in three months between January and March.

Horticulture is a minor land use in the Mackay Whitsunday Isaac region, with sugarcane, grazing and natural areas being the most significant.

The Mackay Whitsunday Horticulture Management Practices: ABCD Management Framework document has been designed to support the identification, validation, implementation and review of horticulture practices that can improve both freshwater and marine water quality and ecosystem health, as identified in the Mackay Whitsunday Isaac Water Quality Improvement Plan (WQIP) (Folkers et al. 2014).

The development of ABCD frameworks for a range of industries is pivotal to implementation, monitoring, measurement and continual improvement through the WQIP process. The ABCD frameworks are designed to highlight and facilitate communication about the different levels or standards of management practices (as opposed to resource condition) for different water quality parameters (i.e. sediment, nutrients and chemicals).

The classification provides a definition and scale of improvement from ***Dated***, through ***Conventional*** and ***Best Management Practice***, to future ***Aspirational*** cutting-edge practices. Over time, changes in knowledge, technology, costs and market conditions may validate ***Aspirational*** cutting-edge practices such that they eventually become ***Best Management Practices***. If ***Best Management Practices*** are widely adopted and become the new industry standard, they may become ***Conventional*** practices, while ***Conventional*** practices may become dated.

A *Aspirational*

- New and innovative practices adopted by growers that require further validation to determine industry wide environmental, social and economic costs/benefits.
- Validation requires R&D and if appropriate, some validated practices will become recommended BMP.
- Development of Farm Management Plans and utilisation of new and innovative technology.

B *Best practices*

- Currently promoted practices referred to as ***Best Management Practices***.
- Widely promoted by industry to achieve current and future industry expectations and community standards.
- Development of Farm Management Plans and utilisation of common technology.

C *Conventional*

- Common practices widely adopted by industry but meet only basic current industry expectations and community standards.

D *Dated*

- Practices superseded or unacceptable by current industry expectations and community standards.

hort360

Hort360 is a computer based tool, which is designed to give a 360 degree view of farm business operations. It assists growers to identify potential risks, capitalise on business opportunities and highlight unnecessary farm expenses. It's a whole of farm business approach.

www.growcom.com.au

For more information please contact Reef Catchments Limited (RCL).

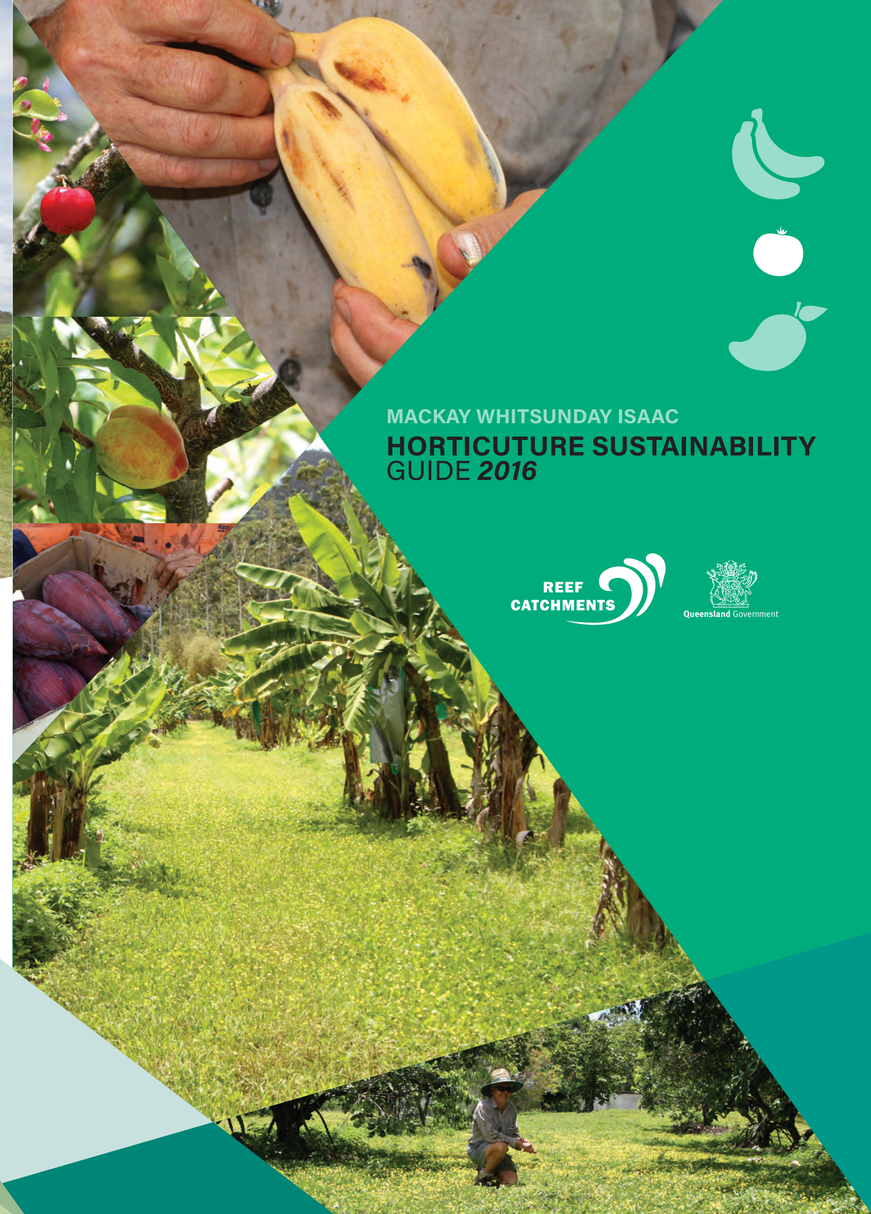
Mackay Office
Suite 1/85 Gordon Street Mackay QLD 4740
P: 07 4968 4200

Proserpine Office
45 Main Street, Proserpine, QLD 4800
P: 07 4945 2321

www.reefcatchments.com

REEF CATCHMENTS

Queensland Government



MACKAY WHITSUNDAY ISAAC

HORTICUTURE SUSTAINABILITY GUIDE *2016*

REEF CATCHMENTS

Queensland Government

Innovation Trial
Microbial Biofertilisers

This Sustainable Agriculture Innovation soil health trial aims to demonstrate improvements in soil health and tree crop productivity in the Mackay, Whitsunday and Isaac regions by applying a range of Mashumus organic fertiliser products.

Ken and Mary Ede have a 5.5 ha, 1,000 tree mango orchard on a 32 ha former cane farm in the Seaforth district that is situated mainly on Wagoora soil. This soil is a moderately deep (0.6m to 1 m), red-brown, non-cracking clay soil that is formed on basic volcanic rocks and occurs on a landscape of gently undulating rises. The trial aims to measure improvements in soil health, fertility and carbon levels by applying homemade Mashumus biofertilisers, with expected outcomes of reduced use of artificial fertilisers, increased nutrient availability and increased levels of soil carbon and water holding capacity.

Trial details

Ken and Mary's farm consists of five blocks of mangoes; Front A and B, the latter of which is to be planted in 2016 wet season, and Back A, B and C. A control site to the south-east of Back A block that does not receive the Mashumus treatments has also been established to enable comparison to the mango blocks. The Wagoora soil is relatively uniform over most of the blocks but changes to a darker, poorly drained soil half way along Back B block. Under-tree mulching is also practiced on the orchard, with the interrow mowings ejected under the trees by a side-throwing mower.

The Mashumus treatments consist of monthly applications of a native microbial seeding (NMS) four day mix, fish emulsion and molasses mixes. The NMS mix is made up of mango leaves from the orchard, grain husk mill run and molasses. The fish emulsion is brewed from fish frames added to the base mixture of cow manure, molasses, milk and yeast.

Four other mixes that supply macro (phosphorous, potassium and calcium) and micro (iron, boron, zinc, cobolt, silica and molybdenum) nutrients are also added to the NMS mix between 1 to 7 times per year. Thirty to fifty litres of each of these mixes are added to a 500 L spray tank that is topped up with water and sprayed onto the mulch layer under the mango trees.

Biological products such as Tricho-Shield (trichoderma fungi), Nutri-Life Platform (arbuscular mycorrhizral and trichoderma fungi) and aloe vera are also applied under the trees on an annual basis to promote the soil microbial populations.

This trial is proudly supported by Reef Catchments, through funding from the Queensland Government (Department of Natural Resources and Mines).

MICROBE PROPERTIES Biomass (mg/kg)	DATE	FRONT A	FRONT B	BACK A	BACK B	BACK C	CONTROL
Total bacteria (15)	March	7.6	9.1	6.5	5.6	5.8	9.5
	August	13.8	18.2	15.1	11.5	10.2	20.7
Total fungi (34)	March	21.6	30.6	26.0	27.3	16.9	35.1
	August	50.9	67.2	55.7	47.3	42.4	69.7
Microbe diversity (80)	March	90.3	43.9	43.7	40.5	46.2	91.9
	August	42.0	40.8	41.8	40.6	38.1	43.7
Fungi:bacteria ratio (2.3)	March	2.9	3.4	4.0	4.9	2.9	3.7
	August	3.7	3.7	3.7	4.1	4.1	3.4

Soil microbes – March and August samplings

PRINCIPLE	MANAGEMENT PRACTICE CATEGORY	D DATED Unacceptable and potentially degrading practices	C CONVENTIONAL Legislative requirement, horticulture code of practice, ETC	B BEST PRACTICES Current best management practice	A ASPIRATIONAL Trialling and testing practices that could provide water quality outcomes
1. Soil Management	1.1 Trees	Inter-rows cultivated.	Inter-rows bare	Inter-rows maintained with active management of grass ground cover and mulched bed.	Actively managed for cover and soil improvement such as intercropping to improve soil nutrition and pest or disease control. Active management of the bed.
	1.2 Plantation - Bananas and Pawpaw's	Cultivated establishment phase, inter-rows cultivated in production phase.	Cultivated establishment phase, inter-rows bare in production phase.	Inter-rows maintained with active management of grass ground cover and mulched bed, minimum till establishment phase, contour planting.	Control traffic permanent beds with GPS guidance for establishment phase, actively managed for cover and soil improvement such as intercropping to improve soil nutrition and pest or disease control.
	1.3 Plantation - Pineapples etc.	Cultivated establishment phase, inter-rows cultivated in production phase.	Cultivated establishment phase, inter-rows bare in production phase.	Inter-rows maintained with as much ground cover as practical in production phase, minimum till establishment phase, contour planting.	Control traffic permanent beds with GPS guidance for establishment phase, cropping and harvesting operations. Interrows actively managed for cover and soil improvement in production phase.
	1.4 Annuals	Cultivated cropping phase, no management of traffic .	Reduced tillage cropping phase, use of multitask machinery, to annually form beds, (lay plastic and drip irrigation).	Developing control traffic systems, strategic till cropping phase, no inter-row tillage, beds reshaped for specific crops.	Control traffic permanent beds with GPS guidance for establishment, cropping and harvesting operations, organic mulches.
	1.5 Fallow Management	Cultivated bare fallow.	Minimal till, grass fallow.	Minimum till cover crop fallow.	Permanent bed cover crop fallow to improve soil health or disease and pest resistance.
	1.6 Headland Management	Cultivated headlands.	Grassed headlands.	Permanent grassed headlands and managed to minimise erosion.	Permanent grassed headlands managed as filter strips.
	1.7 Farm Layout Plan	No soil management plan.	Basic soil management plan.	Soil management plan developed for specific soil types: identify soil types, soil mapping/testing, adjust soil management plan for next year if required.	GPS based soil management plan: identify soil types and productivity zones for each paddock using GPS, using soil mapping and remote sensing, adjusted for next year if required.
	1.8 Machinery	Standard tillage equipment.	Standard tillage equipment.	Bed former, strategic till equipment, mulcher, minimum till seed/seedling planter. Machinery moving towards unified wheel spacings.	GPS based bed former, zonal till equipment, mulcher, minimum till seed/seedling planter.
2. Nutrient Management	2.1 Planning and Monitoring	No nutrient management plan, no records kept.	Basic nutrient management plan, including soil test during fallow. Keep Basic Records - daily diary.	Annual crop specific nutrient management plan, conducts regular soil tests and leaf analysis. Aware of soil types / productivity zones for each paddock, uses harvested yield and remote sensing. Keeps detailed records	Annual productivity zone nutrient management plan including nutrient budget. Conducts GPS referenced soil tests and leaf analysis, manage for soil types and productivity zones for each paddock. Uses harvested yield and remote sensing, keeps spatially referenced records.
	2.2 Fertiliser Application Rates	Application rates based on historic rates or rules of thumb or cost of fertiliser.	Application rates based on industry recommendations and soil testing.	Application rates based on soil and leaf test and productivity zones and accounts for all sources of nutrients. Change fertiliser rates between paddocks if required.	Application rates based on soil and leaf test and productivity zones and accounts for all nutrient sources. Change fertiliser rates for productivity zones within paddocks.
	2.3 Accuracy of Application	Irregular calibration.	Annual calibration or in accordance with manufacturers recommendations.	Calibration to ensure the accuracy of application equipment for example granular product change.	Automated calibration to get instant accuracy of application and monitoring during application.
	2.4 Application Timing	Application does not consider crop stage and weather conditions.	Application does consider crop stage and weather conditions.	Nutrient applications are based on crop stage, 2-3 day weather forecast, soil type and moisture levels (irrigation timing).	Nutrient applications are based on monitoring of crop health and stage, 2-3 day weather forecast, soil type and moisture levels (irrigation timing).
	2.5 Application Method	Surface applied not incorporated.	Mixture of surface incorporated and subsurface applications.	Specific application method utilised to (e.g. subsurface, basal (preplant), fertigation and foliar) to maximise efficiency of nutrient uptake.	Automated specific application method utilised (e.g. subsurface, basal (preplant), fertigation and foliar) to maximise efficiency of nutrient uptake.
3. Pesticide Management	3.1 Planning and Monitoring	No pesticide management plan. No records kept.	Basic pesticide management plan, with pest monitoring and reactive pest control. Keep basic records.	An IPM program has been developed and implemented using pest pressure, soil types, crop stage, surrounding crops and yield mapping. Change pesticide strategy for different blocks if necessary. Document pest monitoring and identify pests. Complete record keeping.	A GPS based IPM program has been developed and implemented using pest pressure, soil types, crop stage, surrounding crops and yield mapping. Change pesticide strategy for different blocks if necessary, document pest monitoring and identify pests, spatial record keeping.
	3.2 Pesticide Application Rates	One Crop protection strategy for each crop based on historic application rates or rules of thumb, and the use of non selective products, irrespective of the control needed.	Multiple crop protection strategies for each crop, uses a combination of selective and non selective products at rates appropriate to control needed.	Paddock scale pest presence and pressure monitoring is used to guide selection and application rate of pesticides. Where practical pesticides that are selective to target species replace non selective, broad spectrum pesticides (strategic pesticide use only).	Variable pesticide strategies within blocks. Management of high pest pressure zones with specific pesticides while also maximising benefit from encouraging natural and introduced biological control agents, i.e. increasing level of beneficial organisms.
	3.3 Application Timing	Calendar scheduled applications regardless of pest pressure or climatic conditions.	Application timing based on evidence of pest and disease pressure and weather conditions, rainfall and wind at time of applications.	Timing pesticide applications with respect to crop stage, pest pressure, irrigation and rainfall, pest scouting governs pest control program.	Variable timing of pesticide applications within blocks with respect to crop stage, pest pressure, irrigation and rainfall. Pest scouting governs pest control program.
	3.4 Application Method	Irregular calibration and maintenance of spray equipment.	Annual calibration or in accordance with manufacturers recommendations.	Modern application technology for improved placement and timing to improve application efficiency, accuracy and to extend the window of opportunity. Calibration to ensure the accuracy of application technology.	Apply variable pesticide strategies within paddocks: specific nozzles, volume, pressure and droplet size matched to specific chemical and variable rate. Computerised application: GPS and/or sensor controlled, and/or control droplet, height control and section control, electronic weather station, use of low volume applicators. Use of crop or weed sensors to target crop canopy. Automated calibration to get instant accuracy of application and monitoring during application
4. Irrigation and Drainage management	4.1 System Design	Irrigation system not suited to majority of soil type or crop e.g. flooding on sandy soils. Basic pumps not necessarily matched to irrigation system. Inefficient reticulation systems.	Irrigation system suited to majority of soil type or crop, marginal capacity to deliver crop water requirement. Pumps designed to suit the application Efficient reticulation system.	Irrigation systems suited to all soil types and crops. Has capacity to deliver crop water requirement. Pumps designed to suit the application. Efficient reticulation system. Irrigation system audit maintained.	Variable rate irrigation systems suited to all soil types and crops, has capacity to deliver crop water requirement. Pumps designed to maximise efficiency, efficient reticulation system with use of controllers and automation, irrigation system audit maintained.
	4.2 Scheduling	Calendar scheduling.	Scheduling based on basic field monitoring using visual/manual assessments such as a penetration test.	Irrigation scheduling based on regular field monitoring to determine plant available water content, moisture monitoring equipment, daily evaporation data, soil type and crop stage. Irrigation water tested for EC and nutrients.	Irrigation scheduling based on regular field monitoring at multiple locations and depths to determine plant available water content. Moisture monitoring equipment, daily evaporation data, soil type and crop stage. Irrigation water tested for EC and nutrients.
	4.3 Run-off Management	No planned drainage management.	Runoff is managed to minimise farm impacts.	Whole of farm runoff including packing sheds etc. is filtered via properly designed and managed traps and buffers.	Whole of farm runoff including packing sheds etc. is filtered via properly designed and managed traps and buffers. Water quality leaving farm is monitored.
	4.4 Uniformity	Application uniformity (DU) unknown. No monitoring.	Irrigation application uniformity (DU) below industry benchmark (<80%DU). Annual farm scale monitoring of irrigation uniformity.	Irrigation system performing at industry benchmark (80 - 85% DU). Annual paddock scale monitoring of irrigation uniformity.	Distribution uniformity consistently above industry benchmarks (typically >90%). Annual paddock scale monitoring of irrigation uniformity.