Managing wetlands in intensive agricultural systems

Ginger production

Water use efficiency and wastewater management drives innovative wetland treatment solution for a ginger farm.

The link between farming and wetlands

Rivers, creeks, lagoons, springs, ring tanks and dams are all wetlands. In fact, Queensland's beautiful coastline is also wetland.

Intensive agriculture relies on wetlands to support a range of production processes. For instance, wetlands regulate irrigation and stock water quality, provide flood management and erosion control and improve pest management (through wetland vegetation). Aside from their on-farm benefits, they are a place to fish, put the boat in, or swim.

Land use practices have the potential to impact both on-farm and downstream wetlands. To ensure wetlands remain functional, farm practices sometimes need to be adjusted. In some instances, building or modifying wetlands can help with nutrient removal, sediment control and water re-use, among others.

This case study is one of a series developed by the Department of Primary Industries and Fisheries (DPI&F) through the Queensland Wetlands Program. It demonstrates the benefits of wetlands in improving farm management and incomes, and the farm practices that contribute to wetland health. The series can be viewed on Wetland*Info* at www.wetlandinfo.ehp.qld.gov.au

Queensland Wetlands Program

The Queensland Wetlands Program

The Australian and Queensland governments established the Queensland Wetlands Program to protect wetlands throughout Queensland.

The Queensland Wetlands Program supports projects and activities that result in long-term benefits to the sustainable management, the wise use and protection of wetlands in Queensland. The tools developed by the Program help wetlands landholders, managers and decision makers in government and industry.

The Queensland Wetlands Program would like to thank Shane Templeton and the following organisation for their contribution to, and support of this product:

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The ginger farm and its environment

The Templeton family farm on Queensland's Sunshine Coast is Australia's largest ginger producer.

Both varieties of Australian ginger are grown: a 'Jumbo' variety for the fresh market and a smaller, Queensland variety for processing. High yields require well-drained, friable coastal soils, high water quality, fertiliser and organic matter.

The Templeton's produce 2500–3000 tonnes of ginger per year, two-thirds of the crop goes to the Australian fresh market and the rest is processed to make a variety of ginger products on the Sunshine Coast.

Ginger is produced on 75 hectares of the 600 hectare farm. The rest is either rotated out of ginger production or supports 600 head of cattle that provide additional income and help manage weeds.

The North Maroochy River and associated riverine wetlands divides the property and it is bordered by conservation and essential habitat areas.

A vision for sustainable production

The Templeton family value maintaining the quality of the many waterways on the property and are involved in local catchment planning and Landcare activities.

Farm manager Shane Templeton says "every year in agriculture is going to be different and it's a process of looking at it year after year and trying to improve".

This management philosophy means that, as new information becomes available, farm practices are re-evaluated to maximise efficiency, profitability and sustainability.

Shane says risk management and the record keeping started with programs like Hazard Analysis Critical Control Point (HACCP) and Workplace Health and Safety. Sustainability and natural resource management is "the next step in that process". He is determined to "do a good job" and intends producing ginger for the next 20–30 years.

Managing wetlands with Farm Management Systems and best practice

The Templeton's are members of Queensland's peak horticulture body Growcom and use the recommended Farm Management System (FMS) to manage their operation. FMS encourages growers to adopt a cycle of improvement: plan, do, check and review. Shane works on the premise that "if you do it right the first time, you won't have problems."

FMS helps growers identify potential risks and opportunities for improvement. Growcom Land and Water Program Leader Rachel Mackenzie encourages horticulture growers to make use of the Growcom FMS, "an essential tool in future planning for all horticulture businesses".

The Growcom FMS complements existing, accredited programs and will help those starting to formalise their farming practices.

Rachel says the benefits of FMS are "enhanced efficiency, economy and effectiveness of future business operations while creating clear objectives and timeframes to work with".

Growcom FMS

What is FMS?

It helps growers:

- plan farm management
- assess the effectiveness of farm practices
- identify opportunities for improvements
- demonstrate management outcomes to external stakeholders

What does it do?

It helps growers plan and document all aspects of a profitable and sustainable farm business.

Modules currently include: water use efficiency and soil health and nutrient management.

Modules being developed include: workplace health and safety; on-farm biosecurity; industrial relations; business management; water quality and wetlands.

How is it delivered?

One-on-one farm inspections with a Growcom field officer and small, targeted grower workshops.

Managing soil and nutrients for farm and wetland sustainability

Growing ginger is an intensive farming operation and good soil and water management is critical for continued productivity. Shane understands soil is a farmer's most precious resource—"you need it on the farm and not in the creek".

To minimise soil movement after tillage and bed-forming, the inter-rows are rolled with a tractor after planting. Sawdust used on top of the planting beds reduces runoff, maintains bed height, increases soil organic matter and helps control root-knot nematode, a major pest of ginger.

Each year, laser levelling is used to improve soil drainage across the production areas, which also helps to manage farm runoff.

Cover crops like oats and Rhodes grass, applied at a rate of 50 kg/ha, and used with increased fallow periods have several benefits:

- organic matter is added to the soil;
- nutrients are retained in the soil profile;
- erosion is minimised;
- soil structure is improved; and,
- cultivation effort is reduced.

Because the cover crops are not hosts for root-knot nematodes, the need for nematicide has been halved.

At the ginger-washing facility, wastewater is directed to a detention basin, allowing sediments to settle out before the water returns to the farm dam. Soil is reclaimed and water is returned to the dam for reuse.

Soil management is different in dry and wet years, and high rainfall events force Shane to re-evaluate soil management across the property.

Nutrient applications are tailored to the farm map of soil types and annual soil tests. Ten to twelve soil parameters are tested to build a picture of representative soils across the farm.

Nutrient management is often adjusted to suit changing conditions and the fertiliser application program is made simple to ensure it is easily understood by staff.

The soil tests showed that savings could be made by reducing nitrogen application. Ginger is susceptible to potassium deficiency, however, so potassium application rates are being tested separately. Shane said they make gradual, not wholesale changes to the fertiliser program because "big changes can cause other things to go wrong".

Managing water and irrigation for farm and wetland sustainability

Ginger has a high requirement for water, so irrigation efficiency and sustainable water use is paramount in producing consistent, high quality yields.

Shane says soil moisture monitoring with tensiometers quickly established that "we were too heavy with our watering early in the season; we fine-tuned the irrigation schedule and now use water when the crop needs it".

The tensiometers have helped maintain yields through variable growing periods and have saved precious water while reducing nutrient losses that can result from over-irrigating. Shane said tensiometers "represent good value when the benefits are taken into account". He said testing new technology against old methods is a perpetual, but ultimately beneficial process.

This process of continued improvement underpinning the FMS has enabled the enterprise to respond to very dry periods. Water saving techniques such as adjusting bed height has improved soil moisture.

Managing wetland vegetation

The North Maroochy River is a priority in the local council's program to improve the health of the river system. Council and community groups have invested in rehabilitation efforts to protect the riverine wetlands and regularly monitor water quality.

Grassed headlands and wide filter strips, which buffer the riverine wetlands and farm dams, are an important part of the farm design. They reduce the risk of pollutants moving off-site and help the business to meet a 'duty of care' for the environment.

Shane says good farm design principles really come to the fore during wet weather. Some soil movement is expected in a high tillage operation that also receives high rainfall, "but if you've trapped it with filter strips you know that you've stopped it moving off the farm and can pick up the soil later".

Weed management in these sensitive areas includes light 'crash' grazing pressure from cattle. This reduces weeds without losing grass cover or damaging soil structure.

Wind breaks planted between blocks protect the soil and crop from drying winds and reduce spray drift. It is important to use the right type of tree near the production area because some species can interfere with machinery. Tall species with few lateral branches, like clumping bamboos (Bambusa oldhamii and Dendrocalamus brandisii), are a good option. Growers are advised to carefully choose windbreaks species that are suitable for their location.

The bamboo wind breaks provide protection and favourable growing conditions which result in higher yields in nearby production areas. Shane uses disc harrowing and ripping during the pre-plant phase to discourage bamboo runners from establishing.

In the future there may be an opportunity to harvest edible bamboo shoots or timber products from the wind breaks.

The shelter belts and vegetation retained along creeks and wetlands also provide visual and noise buffers between the farm and neighbouring properties. Shane believed that maintaining healthy riparian vegetation bene.ts horticulturalists by providing buffers and bank stability as well as improving crop performance.

The Templeton family acknowledge Landcare's help to achieve revegetation goals. They encourage other growers to enlist regional Natural Resource Management groups to help implement best practice options for farm wetlands.

So what's the bottom line?

Production systems are complex and it can be dif.cult to isolate the economic impact of individual practices. In most cases several practices contribute to improved productivity and reduced environmental risk.

The practices implemented by the Templeton's have enhanced farm pro.tability and sustainability. Improvements to the farm's bottom line have been achieved by reducing input costs, improving yield improvement or a combination of both.

A combination of cover cropping, crop rotations and post-plant sawdust application has reduced nematicide use by around 10,000 litres per year and contributed to improved soil health, and reduced runoff and herbicide use.

Better irrigation and nutrient management has reduced the amount of fertiliser used and increased productivity by around 40–50 tonnes of ginger per year.

Shelter belts have improved yields in some parts of the farm, reduced spray drift to wetlands and provide a buffer to urban encroachment.

Costs and bene.ts of practices implemented in the business are summarised in the table opposite.

Going the next step

The Templeton's participation in the Australian Ginger Growers Association has helped them develop new ideas and knowledge about growing ginger. Shane said .eld and information days helped generate new ideas and "keep the mind ticking over" and the ginger industry bene.ts from grower input. Although competitive, the ginger industry encourages cooperation to maintain a high quality, fresh product.

The Templeton's are working with DPI&F in trials of minimum tillage and controlled traf.c farming, designed to reduce soil compaction and increase bene.cial soil fauna. The project is also examining the effect of minimum tillage, crop rotation and using organic amendments (sawdust and poultry litter) on root-knot nematodes and fusarium yellows.

Minimum tillage appears to improve soil biological activity, which, in turn, suppresses soil borne pathogens. Combined with added organic matter, this increases soil carbon and nitrogen. Further reductions in the use of fertiliser and soil fumigants are expected to improve the farm's economic bottom line.

Continued improvement extends along the supply chain to the Sunshine Coast's ginger processor 'Buderim Ginger', who has introduced a range of practices to improve business ef.ciency.

Buderim Ginger Process and Engineering Manager Steve Dennis said ef.cient processing practices complement what growers like the Templeton's are doing. The Business Water Ef.ciency Program has halved water consumption, saving around 200,000L of water per year. In addition, waste heat is recovered and returned to the processing area.

	Annual costs and benefits of the 'best practice' options undertaken			Estimated crop benefits arising from crop protection practices	Estimated crop benefits through soil nutrient and irrigation management	
Practice implemented	Pre-plant cover cropping with pasture grasses	Applying sawdust post-planting	Crop rotation	Establishing wind breaks (bamboo)	Soil testing (nutrient management)	Irrigation management (tensiometers)
Cost of implementation	$184 per ha (includes cultivation, seed and spreading costs)	$1,780 per ha (includes application costs)	n/a	$133 per hectare (includes purchasing, planting & maintenance) Minor loss of productive land (not costed in this example)	$300–$500 per year	$500–$1000 (depending on number and type of unit)
Benefits from implementing practices	• Nematode control • Suppression of soil pathogens • Increased soil organic matter • Improved retention of soil nitrogen • Yield improvement • Reduced tillage effort • Erosion control • Weed management • Improved soil health • Cattle forage			• Yield improvement • Reduced spray drift	• Yield improvement • Fertiliser efficiency	• Water use efficiency • Improved fertiliser efficiency
Inputs reduced	Nematicide and herbicide				Fertiliser	Water and pumping costs
Quantifiable benefits (per year)	While variable costs increased by 8.9% with the introduced practices, or BMP's, the gross margin per hectare (gross income less variable costs) increased by 5.6%, attributable to the improvement in yield.[1]			The increased yield gave an associated increase in the gross margin per hectare (gross income less variable costs) of 4.7%.[2]	The gross margin per hectare increased by approximately 2.5%.[3]	Unable to be determined.
Assumptions	Assumes nematicide use reduced by 10,000L per year over a 75 ha productive area (equates to 133L reduction per ha) and a variable amount of herbicide. Yield improvements are assumed to be in the order of 7–8% from a combination of the implemented practices.			Assumes a 2–3% yield improvement is gained from sheltering the crop	Assumed to save an estimated $100 on the total fertiliser cost per hectare (pre and post plant). Average yield increase per hectare of 500 kg.	One off purchase of capital items.

1 Assumption: quantifiable benefits are based on a farm base gross margin (without the introduction of best management practices) and uses total variable costs per hectare and an average yield of 46.25 tonnes per hectare (combination of fresh and factory ginger). Prices used in the analysis—fresh ginger $2,500 per tonne and factory ginger $1,100 per tonne.

2 Assumption: quantifiable benefits are based on a farm base gross margin (including the best management practices) and uses total variable costs per hectare and an average yield of 50 tonnes per hectare (combination of fresh and factory ginger). Prices used in the analysis—fresh ginger $2,500 per tonne and factory ginger $1,100 per tonne.

3 Assumption: quantifiable benefits are based on a farm base gross margin (including the best management practices) and uses total variable costs per hectare and an average yield of 50 tonnes per hectare (combination of fresh and factory ginger). Prices used in the analysis—fresh ginger $2,500 per tonne and factory ginger $1,100 per tonne.

Sustainable outcomes for horticulture and healthy waterways

The Templeton farm demonstrates how FMS and continued improvement represent good farm management, bringing improved pro.tability and sustainability. The Templeton's understand that at the end of the day "you don't give up on improving farm management and hopefully you get it right most of the time".

These practices are also contributing to wetland protection by reducing nutrient and sediments loads and increasing beneficial vegetation.

Acknowledgments

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Other Products

Managing wetlands in intensive agricultural systems—cane production

Managing wetlands in intensive agricultural systems—cotton production

Managing wetlands in intensive agricultural systems—dairy production

Managing wetlands in intensive agricultural systems—nursery industry

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