Healthy Country

managing the land for healthy waterways

Horticulture and cropping benchmark update

Lockyer and Bremer catchments

June 2010

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SEQ Catchments

Queensland Government

Horticulture and cropping benchmarking report

Lockyer and Bremer catchments

June 2010

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Executive summary

Benchmarking has been conducted with approximately 55% of growers in the Bremer and Lockyer catchments. This includes 85% of growers in the Bremer catchment, which is comprised of a much smaller grower base, and approximately 45% of growers in the Lockyer catchment. Management practices within these regions are predominantly C practices with increasing numbers of B practices.

In total, 35.7% of benchmarked producers have implemented changes to their farming systems to improve soil and nutrient management. The majority of these practice changes have direct implications for reducing the potential movement of soil and nutrients off-farm. Within the Bremer and Lockyer catchments, 36.4% and 34.4% of growers respectively, have changed management practices. Practice changes have primarily been to B classified practices from either C or D practices.

Key areas for improvement are in tillage practices, on-farm infrastructure to reduce sediment losses off-farm and more efficient use of fertilisers. The nature of on-farm practice changes are presented in more detail in the following report.

Introduction

The following report contains information from benchmarking undertaken to date through the Healthy Country program. The report focuses on current management practices of primarily horticultural producers in the Lockyer and Bremer catchments, in particular practices associated with soil and nutrient management. Some benchmarking of lucerne, grain and fodder producers has also been undertaken.

This report was compiled as part of the '*Healthy Country: managing the land for healthy waterways* program. Healthy Country is a partnership between the Queensland Government, South-East Queensland Catchments (SEQC) and the Healthy Waterways Partnership with collaboration with SEQ Traditional Owners Alliance (SEQTOA).

Benchmarking methodology

Data is presented in the report in terms of the South-east Queensland ABCD framework for horticulture. The South-east Queensland ABCD framework for horticulture was developed in 2009. Since then all benchmarking has been conducted against this framework. Benchmarking undertaken prior to its development has since been retrospectively adapted to the ABCD framework.

The framework classifies practices based on their ability to achieve improvements in resource condition (i.e. reduce degradation) and their consequent impact on farm profitability.

D (4) class practices are 'dated' practices that have unacceptable risk of potential impacts on the surrounding environment or that will ultimately lead to degradation of resources and a decline in profitability in the short to medium term.

C (3) class practices are 'conventional' management practices that reduce the risks/impacts compared to class D however, are unlikely to lead to an acceptable resource condition if applied widely and hence lead to reduced profitability in the medium to long term.

B (2) class practices are those that are the currently recommended 'best' management practices which have been demonstrated to minimise risk off farm and resource degradation and can lead to improvements to profitability in the short to medium term.

A (1) class practices are 'aspirational' practices that are relatively recent innovation which further minimise risks and potential degradation compared to B class practices but require further studies to validate their impact on resource condition and profitability.

The level of benchmarking varies for each enterprise. Some has been completed through detailed one on one informal discussion (semi-structured interviews) with producers. Other benchmarking results are based on a snapshot of their practices from brief conversations and may not represent all management practices in the farming system. All demonstration and trial site co-operators have been benchmarked in detail. Changes in on farm practices have also been identified in benchmarking updates with growers previously benchmarked.

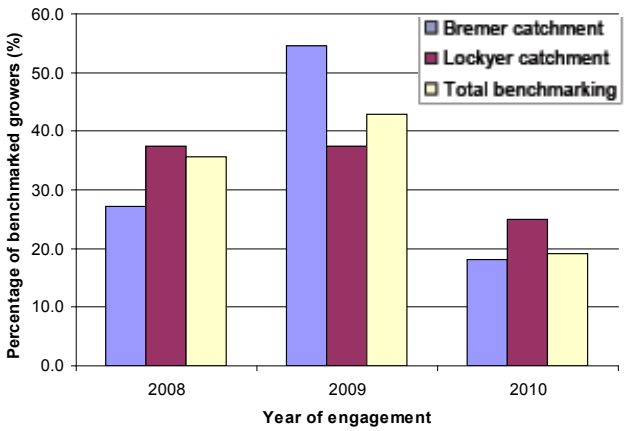

Figure 1. Year of engagement in the Healthy Country project

The ABCD classifications for individual practices have been averaged for each area of management. For example, a producer may have two 'B' practices, three 'C' practices and one 'D' practice for soil and sediment management but the overall classification for this area of management will be a 'C'. The data presented is current as of June 2010 and includes updated classifications for those who have made management changes.

Benchmarking has primarily been focused on management practices associated with soil and sediment management and nutrient management. Where possible some information has also been collected on irrigation and drainage management with particular emphasis on drainage management.

The data in this report indicates the number of trial and demonstration sites established in horticulture through the Healthy Country program. There is also additional information in the report based on grower feedback on recommended best management practices and the challenges and drivers for adoption.

General information

Approximately 50% of growers (n = 55) across the priority catchments of the Lockyer and Bremer have been benchmarked to date through the Healthy Country program. These figures may be slightly higher than reality as grower databases and contacts are still being developed. This includes approximately 85% of growers in the Bremer catchment (n = 13) and 45% of growers in the Lockyer Valley (n = 42). Farm sizes of those growers surveyed ranged from 30 ha to 400 ha. Figure 1 depicts the percentage of these growers engaged in each year of the Healthy Country program.

A wide range of crops are grown by these producers including:

- Potatoes
- Celery
- Lettuce
- Beetroot
- Broccoli
- Cabbage
- Barley
- Grape tomatoes
- Cherry tomatoes
- Capsicum
- Wheat
- Cauliflower
- Sweet corn
- Green beans
- Carrots
- Onions
- Shallots
- Watermelon
- Pumpkin
- Tomatoes
- Adzuki beans
- Chinese cabbage
- Broccolini
- Raddish
- Silverbeet
- Lucerne
- Lablab
- Sorghum
- Mungbeans
- Soybeans
- Wombok
- Millet
- Baby salad leaves

Table 1 contains an indication of the landuse of those enterprises benchmarked to date. Horticulture has been the primary landuse that has been benchmarked to date due to its proximity to waterways in the priority catchments and also due to the intensiveness of soil management operations associated with this industry. As can be seen in Table 1 the majority of horticultural producers also produce lucerne, grains and fodder. ~~Some~~

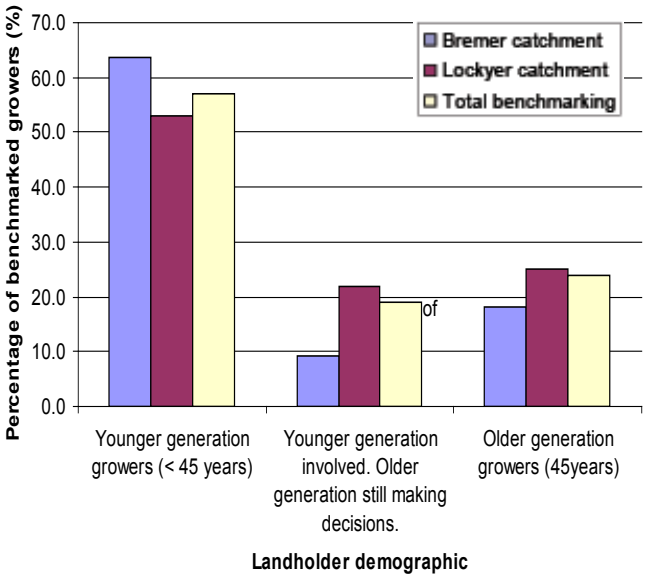

Figure 2. Landholder demographics of benchmarked enterprises

Table 1. Landuse of benchmarked landowners (%)

	Bremer (%)	Lockyer (%)	Total benchmarking (%)
Lucerne, grains, fodder	18.2	12.5	11.9
Horticulture, lucerne, grains, fodder	63.6	50	54.8
Horticulture	18.2	37.5	33.3

~~benchmarking of lucerne and grain and fodder producers has also been undertaken.~~

Figure 2 depicts the age demographics of benchmarked growers. The majority of farming enterprises benchmarked to date are managed by the younger generation (less than 45 years of age). There are still significant percentages of farming operations where the older generation are still involved in decision making for the business or that are older generation producers themselves.

A number of on farm demonstration and trial sites have been established in each of the priority catchments (Figure 3). These demonstration and trial sites include nutrient balance and nitrogen use efficiency demonstrations and trials, a sediment monitoring demonstration site and controlled traffic farming co-operators. Each of these co-operators has been benchmarked in detail. Of those that were involved in on farm trials and demonstrations 47.4% have made some change to their management practices.

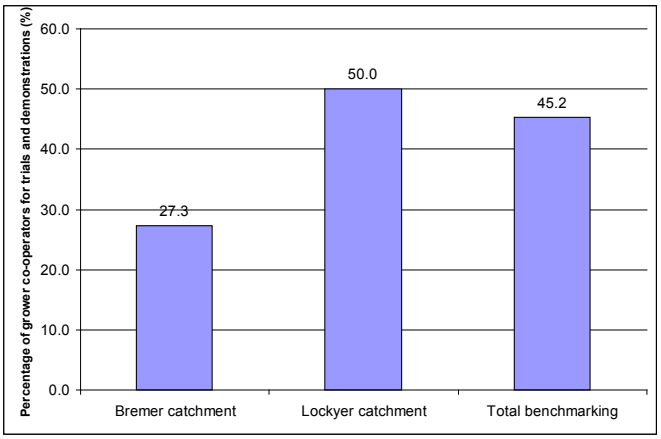

Figure 3. Demonstration and trial site co-operators in each priority catchment and in total.

Benchmarking results

Horticultural production

Changes in management practices to date

In total, 35.7% of cropping producers benchmarked through the Healthy Country program have made some change to their soil and nutrient management practices. Figure 4 indicates in which areas of management these changes have been made. In some cases producers have changed more than one aspect of their farm management system. For example, one grower has made changes to his tillage practices, sediment and drainage management. Another has made changes to his sediment management through increased cover cropping and putting in place grassed headlands and sediment traps; soil management by reducing primary tillage practices by 40%; and drainage management by laser levelling and improving drainage systems. Of those growers that have changed their management practices 64.3% were trial co-operators.

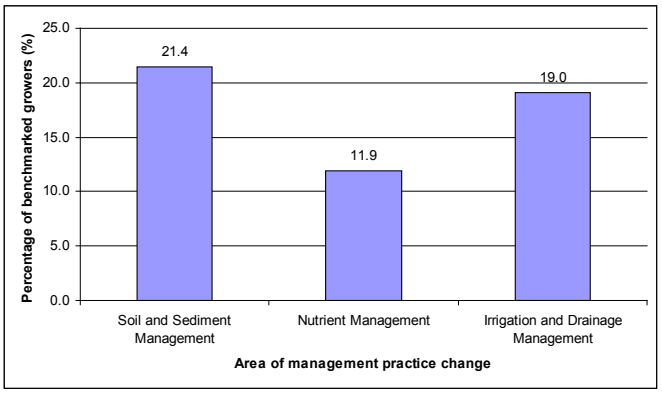

Figure 4. Changes in management practice across all benchmarked growers

Within the Bremer catchment 36.4% of benchmarked horticultural producers have made changes to some aspect of their farm management since the commencement of the Healthy Country program. Figure 5 indicates in which areas of management these changes have been made. These changes include such practices as the implementation of a controlled traffic farming system with the aim of minimising tillage where possible, the use of controlled release fertilisers across farming operations to maximise the use of nitrogen by the plant and reduce the potential for off farm losses.

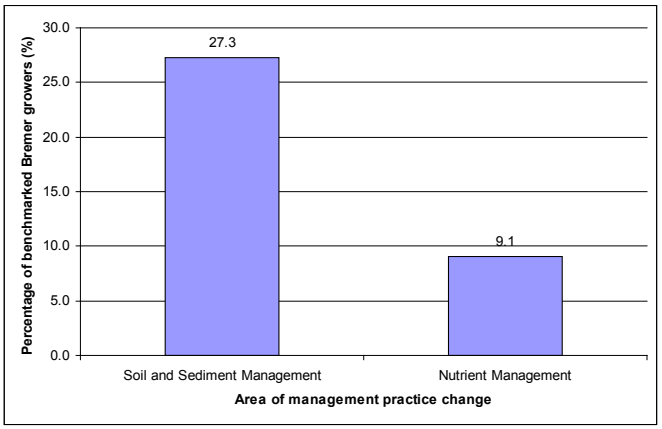

Figure 5. Changes in management practices in the Bremer catchment

Within the Lockyer catchment 34.4% of horticultural producers have made changes to some aspect of their soil and nutrient management practices since the commencement of the Healthy Country program. Figure 6 indicates in which areas of management these changes have been made. This includes changes to horticultural practices as well as changes to practices associated with other crop production such as grains, pulses or fodder. Changes include the implementation of controlled traffic farming and minimised tillage systems, adoption of technology to facilitate banded fertiliser applications and fertigation, changes to fertiliser programs to improve fertiliser use efficiencies, incorporation of regular cover cropping into the rotation and the development of erosion mitigation infrastructure.

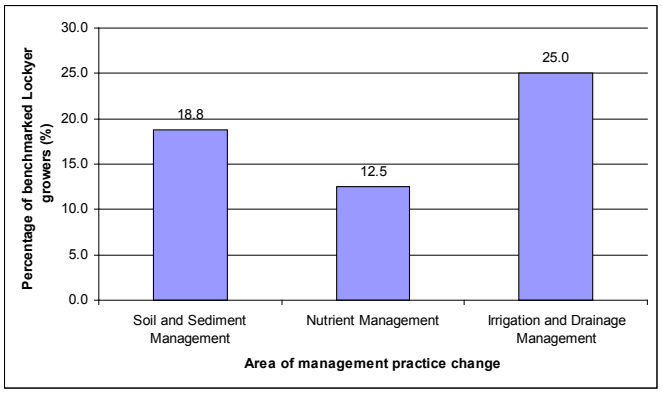

Figure 6. Changes in management practices areas in the Lockyer catchment

Soil and sediment management

Soil and sediment management aspects of the ABCD framework include fallow management, tillage practices and erosion mitigation infrastructure.

The majority of soil and sediment management practices benchmarked in both the Bremer and Lockyer catchments can be classified overall as C practices. The Bremer region has had very little to no previous extension services in horticulture. There is very strong interest in the work conducted through the Healthy Country program including controlled traffic farming systems and nutrient monitoring demonstrations to optimise fertiliser programs. The predominance of crops such as carrots in the Bremer has also limited the extent that tillage practices can be reduced due to the severe compaction caused by available harvesting technology.

The majority of changes to soil and sediment management practices across both regions were from C to B (Figure 9). Continuing the extension effort with a focus on these areas of management in these regions should see a shift to a greater percentage of growers with 'B' practices. This is evident in Figure 9 where the majority of changes in farming practices have been from C to B.

The changes in farm practices from a C to a B practice reflect a range of management practices including the incorporation of green manure cover crops as a standard component of the rotation and

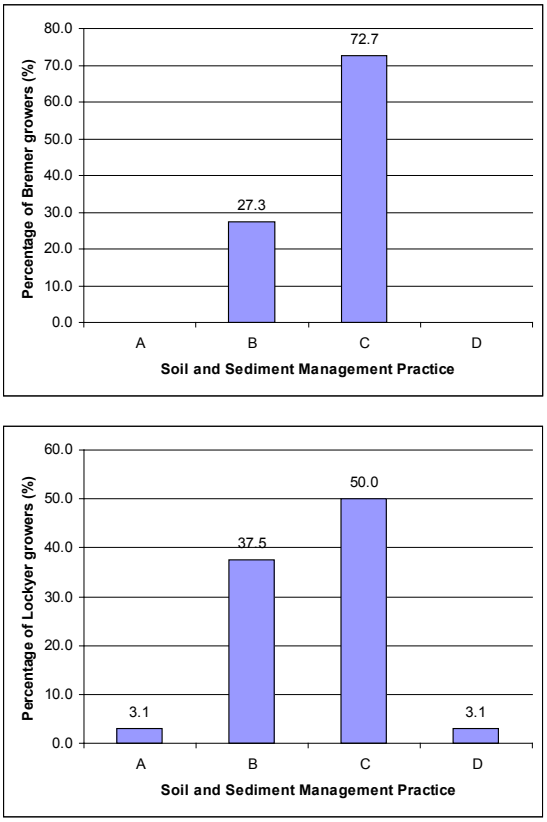

Figure 7 8. Benchmarking of Soil and Sediment Management Practices in the Bremer (top) and Lockyer (lower) catchments.

Changes in Soil and Sediment Management

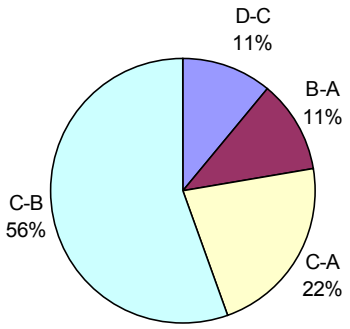

Figure 9. Changes in Soil and Sediment Management Practices

putting in place various infrastructure such as sediment traps and drainage to reduce the risk of soil losses off farm. The change from D-C, C-A and B-A practices reflect minimising tillage, the adoption of controlled traffic farming systems and a move to permanent beds for consecutive crops where possible.

Cover cropping

The majority of growers engaged so far through the Healthy Country program are aware of the benefits of cover in reducing the erosion potential of their soil and the high risk associated with the summer rainfall period. Cover crops are incorporated into the rotation primarily to add organic matter and reduce the risk of soil loss. Any nutrient contributions and improved soil structure and yield are additional benefits.

Approximately 80% (78.5%) of benchmarked producers attempt to regularly incorporate a cover or opportunity crop into their rotation to ensure fields have some cover to protect against erosion events. Of the remaining 20% most will try to ensure that their fields have a commercial crop during high risk periods so fields are not left bare. Producers in these regions do not tend to differentiate between a green manure crop and an opportunity crop that they may receive some income from. Regardless of the crop the purpose in planting it is to ensure that the field is not left bare.

Only 31% grow green manure crops. The recent drought saw a shift away from green manure crops with more emphasis on ensuring an income where possible. Green manure cover crops over the summer period are predominantly lablab, forage sorghum and some millet. Depending on the hay price forage sorghum may or may not be baled. Some growers will also grow opportunity crops during winter such as wheat and barley. Horticultural producers who include lucerne in the rotation may view it as a cover crop.

The benchmarking process has also identified those factors that constrain the incorporation of a cover crop into the farming system. Cover cropping is dependent on sufficient rainfall and soil moisture to establish the crop. As irrigation water is the most limiting resource in their production system producers will not irrigate a cover crop that they will not see significant financial return on.

The decision whether to cover crop or not will also depend on the vegetable crop rotation. Horticultural production in these areas is very intensive and producers can grow up to 5 crops in 2 years. Cropping intensity tends to vary from 1-2.5 commercial crops per year. Depending on the rotation there may not be sufficient time between crops for a cover crop. Seedbed preparation for some crops is traditionally very intensive and this summer period may be set aside for these operations depending on the rotation and planting windows. If there was a cover crop in the ground then there may not be sufficient time for seedbed preparation prior to planting.

Quality issues are also a concern for growers with some crops. Bulb and root crops such as potatoes, carrots and onions can have serious quality issues if there are large amounts of crop residues in the soil during development. These can cause skin imperfections or deformations that can make the product unmarketable.

Feedback from local vegetable producers has also repeatedly highlighted an interest and requirement for more information on cover cropping for vegetable production systems. This includes cover crop options, soil health benefits (soil carbon and nutrient contributions, soil structure, water holding capacity) and interactions with other aspects of their production system (stubble and residue management, disease and pest implications).

> "we have a lablab rotation on half our country every year so our country will have lablab every two years and we have cut back on number of crops per year so we can stop flogging our country and improve our soils

Tillage practices

Benchmarking has revealed that the majority of growers (88%) have reduced their tillage practices to some extent compared with the previous generation. Responses from producers have indicated between a 30-50% reduction in tillage over the last 5-10 years. Interest in controlled traffic farming systems and minimum tillages systems is increasing. Currently 16.7% of benchmarked growers have or are in the process of implementing a controlled traffic and minimised tillage system. They have indicated up to 40% fuel savings are possible with these systems. Some growers have also been able to reduce their fertiliser rates under minimum tillage systems. Of those benchmarked 33.3% have GPS guidance technology.

Controlled traffic systems do not easily integrate into horticultural systems and there are still many challenges to its implementation. Many of these are associated with machinery limitations that require co-operation of manufacturers or significant engineering modification to existing machinery. The availability of incentive funding able to fund machinery modifications would greatly assist with the adoption and further development of these systems. There are also some system integration issues that could be addressed through farming system trial work as well as changes to cultural practices.

> "controlled traffic is the way to go" "way of the future" way we used to work before used to cross rip and everything – no need for it

> "I would love to get GPS guidance but it's just so expensive"

Erosion control infrastructure

Most growers already have in place grassed drainage networks around fields and have diverted overland flow off cultivation where possible. However, one area for further improvement is in those parts of the catchment where major drainage lines run through cultivation fields. Only a minority of producers currently protect these drainage lines with vegetation, most still cultivate through them.

The majority of producers have in place on farm dams that also act as sediment traps. These dams are primarily storage facilities for irrigation water but due to their placement in the farm drainage layout are also able to capture sediment before it moves off farm. Others have put in place specific infrastructure to capture sediment. Much of the erosion control infrastructure work that has been undertaken by landholders has been in the focal area where growers have had access to incentive funding. Growers outside the focal area have undertaken this development at their own expense. The implementation of this infrastructure would be more widespread with incentive programs across the catchment.

> "no-one is more concerned than I am about soil loss from my fields … the soil is the basis for my business"

Soil quality

Very few growers actively measure any aspect of their soil quality apart from recognising that compaction is an issue and monitoring organic carbon in any soil testing they do. Soil carbon is currently the only meaningful measurement of biological health of the soil. All crop residues are returned to the soil although the amount of residues varies with the crop grown. Where cover crops or opportunity crops are grown, building soil carbon is a key driver for these practices.

Nutrient management

Nutrient management aspects of the ABCD framework include soil testing, fertiliser rate, application and storage and consideration of other sources of nutrients.

The majority of nutrient management practices benchmarked in the Bremer and Lockyer catchments can be classified overall as C practices.

The majority of changes to nutrient management practices were from D to B and some C-B (Figure 12). These changes have contributed significantly to the percentage of B classified growers in these regions.

The changes from D-B reflect the implementation of technology and equipment to facilitate more efficient application and placement of nutrients. This includes fertigation equipment as well as machinery to band fertiliser applications so that they are not broadcast and applied where the plants will be unlikely to utilise them. Other changes in management practices (C-B and D-C) include the move to controlled release fertilisers to better match fertiliser availability to plant use and improvements in fertiliser programs to improve nitrogen use efficiency.

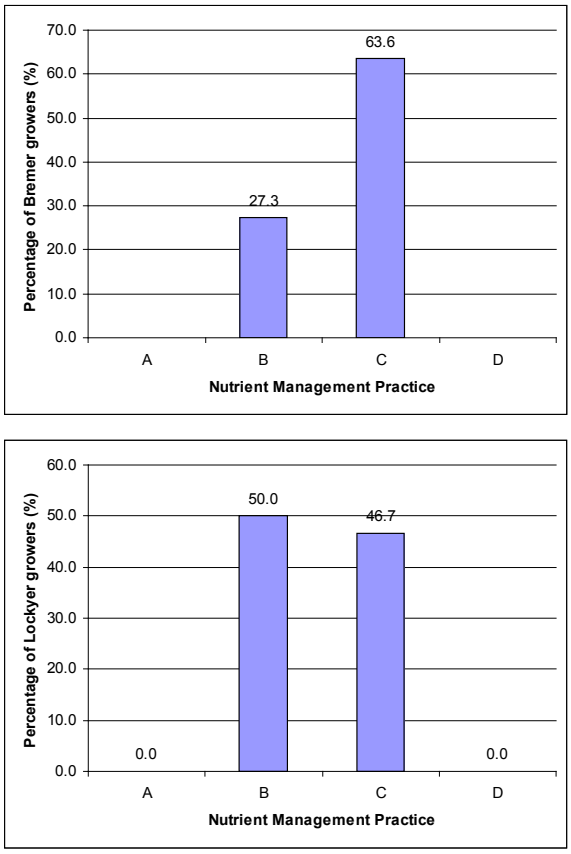

Figure 10 11. Benchmarking of Nutrient Management Practices in the Bremer and Lockyer catchments.

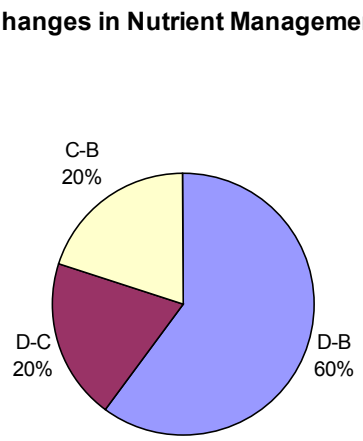

Figure 12. Changes in Nutrient Management Practices

Soil testing

Some soil testing is conducted by 81% of benchmarked producers. Regular soil testing is conducted by 54.8% of benchmarked producers. Of those that don't soil test this is primarily because they have found they were paying for a service that didn't give them any new information. The recommendations from testing were the same from year to year.

Fertilisers

Application rates

Of interest is the feedback that producers that do soil tests do not use the results to determine fertiliser programs. Soil test results are used primarily to follow fertility trends over time and check fertiliser programs and indicate where potential deficiencies may arise. Only a very small minority use the results to inform fertiliser programs. Nutrient management programs are based on a variety of information including soil tests, field history, previous yield and known soil limitations and deficiencies. The industry has very little information on industry standards for fertiliser rates but some of the monitoring work undertaken through the Healthy Country program will contribute to a greater understanding of this. The majority of producers base rates on recommendations from reseller agronomists and standard fertiliser programs.

Very few growers take into account the contributions of nutrients from legume rotations or irrigation water. Growers with legume rotations have indicated that they would if they were able to get some accurate information on what those contributions may be given climate, soil type and farming system practices. Organic growers are the exception as legume rotations can be a significant source of N requirements in addition to organic amendments and organic fertilisers.

Application methods and storage

Benchmarked producers are increasingly using split and banded fertiliser applications to improve the efficiency of fertiliser applications and use by plants. Producers maintain and operate fertiliser equipment as efficiently as possible. Fertilisers also tend to be stored in a way to minimise potential contamination. Bulk fertilisers tend to be stored in chemical sheds that have been developed to comply with the strict legislative requirements for safe storage of pesticides.

"we moved to banded fertiliser applications as it was a waste to be applying nutrients in areas of the field where the plant wasn't growing.."

"GPS guidance technology means we can come back to those fertilised bands in subsequent crops if we have a crop failure

Irrigation and drainage management

Irrigation and drainage management aspects of the ABCD framework include irrigation application and scheduling, irrigation system and efficiency, water quality testing and drainage management. This area of management is the least comprehensively benchmarked and as such general findings will be discussed rather than actual figures.

All changes to irrigation and drainage management practices were from C-B. The changes from C-B reflect the implementation of drainage infrastructure or practices to ensure effective drainage from cultivated areas and to minimise sediment loss through this drainage system. This includes laser levelling of all cultivation and development of permanent drainage systems.

Irrigation application generally takes into account crop and soil type. The cost of establishing and producing a crop are such that producers will base their crop area on their water availability.

Irrigation systems in these catchments are predominantly solid set irrigation. Other irrigation systems used include centre pivot and lateral move irrigators, drip irrigation and the odd water winch. All producers recognise the water savings associated with drip irrigation and most will use it where they can. However, the cost of drip generally prohibits its implementation across the whole farm and there are also issues with waste and the ability for tape to be reused in consecutive crops. Some form of overhead irrigation is also required to establish seedling crops.

Less than 10% of benchmarked growers still actively utilise irrigation scheduling equipment. This has been consistent across benchmarking to date. Most irrigation scheduling is based on subjective assessments of the crop and weather as well as knowledge the producer may have gained through past use of scheduling tools (93%).

The Lockyer catchment in particular has variable water quality and growers generally undertake testing if they are in an area known to have salinity issues. None of the growers benchmarked test their water for nutrients.

About 20% of benchmarked producers have been involved with some assessment of their irrigation system efficiency with Growcom. So far no producers have been identified that calculate some measure of their crop water use efficiency.

I did use tensiometers to get an understanding of my crop water use under different conditions – but now I schedule irrigation based on that knowledge"

Lucerne production

Lucerne is probably the best cropping landuse to minimise sediment loss. Lucerne rotations generally last between 3-5 years with approximately 7-8 cuts per year. A lucerne rotation provides year round cover for the duration of the crop. It is broadcast planted, not on furrows or beds, so cover is across the total field area. For most lucerne producers in the region, lucerne is their primary crop and they may grow pumpkins or a fodder/grain crop as rotations. Lucerne is an irrigated crop and as such also can be located adjacent to waterways in the region.

Nitrogen fertiliser tend not to be used with lucerne as it fixes its own nitrogen in the soil. Some growers may apply some potassium if needed but this is a relatively immobile nutrient and inputs would be well under crop removal. Fertiliser inputs are generally minimal in lucerne reducing the likelihood of losses off farm. While the majority of lucerne biomass is baled, some is also returned to the soil as organic matter during the cutting, windrowing and baling processes.

Lucerne also involves minimal tillage. The crop is in production for several years and generally only requires some primary tillage to prepare the ground for planting. There is some concern that lucerne may result in compaction issues due to the machinery operations associated with cutting and baling and the lack of defined traffic pathways in the field. However, lucerne does not have the same market pressures that apply to vegetable production and therefore does not tend to be trafficked when wet, minimising the risk of compaction.

Grains and fodder production

Grains and fodder production in these priority catchments are generally very small scale systems. Grain and fodder production does not tend to be associated with irrigation as the returns on these crops at these scales are not sufficient to make irrigation cost effective. Benchmarking has been conducted on some of the larger scale operations. These tend to be previous horticultural producers who have changed to a less intensive cropping rotation as they approach semi-retirement or have a significant grains component as a rotation for their horticultural crops.

Grain production includes wheat and barley and some pulses such as soybeans and mungbeans. Grains production does not have the same intensive tillage requirements as horticulture. Of those grains producers benchmarked to date 100% have implemented minimum tillage systems. However, further improvements could be made in these systems. At the moment cost is prohibiting the purchase of necessary machinery. Grain production in this region varies from that in larger broadacre areas of production. Cropping intensity is greater in these regions and farming areas are smaller so there is less area for rotation and time available for stubble breakdown. Consequently, these producers are having issues with stubble management in their minimum till systems.

Fodder production is generally undertaken by graziers who may have one or two small areas that they produce some fodder on as a supplement to their grazing pastures. Benchmarking has indicated that changes to management practices are limited by the following factors:

- it is not their primary source of income
- generally only have basic machinery to carry out necessary operations
- minimal input systems
- motivation and drivers for making any improvements in practices are low.

Conclusion

The 2010 benchmark shows a positive trend in BMP adoption with over one third of producers changing to more sustainable practices.

Key areas for improvement are in tillage practices, on-farm infrastructure to reduce sediment losses off-farm and more efficient use of fertilisers.

It is clear from the data that these practices are starting to become core business rather than the province of the 'innovators' and 'early adopter farmer groups. With adoption strongly correlated to the availability of funds for trials and/or incentives for implementation, a key area for enhancing the level of uptake is the broader availability of investment to high risk landscapes outside the spatially limited Healthy Country Project focal areas.

The results from this round of ABCD benchmarking indicate the Queensland Government investment in the the FarmFLOW Framework has facilitated participatory action learning and capacity building in agri-industries and is achieving the desired adoption of BMP to reduce the off-farm flow of sediments and nutrients.