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SEQ Horticulture ABCD framework: supporting documentation

Introduction

The ABCD framework for Southeast Queensland is a best practice management benchmarking tool. It can be used to assist SEQ producers and other organisations to identify current agribusiness practices and management as well as highlighting recommended management practices and innovative cutting edge practices. The ABCD framework includes sustainable management practices that also contribute to achieving profitable productions systems.

The information in this supporting documentation is intended to be used by those assessing practices against the framework. It contains additional information intended to ensure a common understanding with regard to each management practice in the framework as well as providing links to further information to assist with practice improvement.

1. Soil and sediment management practices for horticulture ABCD framework

1. Cover crop/green manure crop on bare fallow

Providing cover to bare fallow fields is the most effective way to reduce soil erosion losses from cultivation areas. There are a range of cover crop and green manure crop options for fruit and vegetable production in South-east Queensland. The type of cover crop used depends on the season, with oats and barley suitable for autumn, winter and spring, and lablab, cowpeas, sorghum or millet in summer. Root-knot nematode resistance rating can be important in your choice of cover crop for a range of fruit and vegetable crops.

Legume cover crops can also contribute nitrogen to the farming system which should be considered in Nutrient Management Practices for Horticulture.

Table 1. Cover crops suitable for Southeast Queensland. Note the respective resistance to root-knot nematodes (RKN).

Cover crop	RKN resistance rating	Season
White French millet (*Panicum ilaceaum*)	very high	spring/summer
Pearl millet (*Pennisetum glaucum*)	moderate	spring/summer
Foxtail or panorama millet (*Setaria italica*)	moderate high	spring/summer
Japanese millet (*Echinochloa esculenta*)	moderate	spring
Jumbo/forage/sweet sorghum (*Sorghum bicolour, S. spp*)	high	spring/summer
Pinto peanut (*Arachis pintoi*)	high	summer
Oats (*Avena sativa*) (Panorama, Algerian, Culgoa 11, Amby 11)	high	autumn/winter
Oats (*Avena sativa*) (Condamine, Enterprise, Graza)	moderate	autumn/winter
Lablab (*Lablab purpureus* formerly *Dolichos lablab)*	low	summer
Cowpeas (*Vigna unguiculata*)	low high with cultivar	summer
Barley (*Hordeum vulgare)*	moderate	autumn/winter

2. Minimise tillage

Attempts must be made to reduce the negative impact cultivation equipment has on soil structure. Rotary hoes and disc cultivators usually cause more soil structure damage than tined and non-inverting implements. Remember each cultivation pass contributes to soil structure breakdown. The number of cultivations during plot preparation should be recorded to keep track of the number of passes being made with a view to reducing them in the future. Table 2 provides a guide to recommended tillage practices considering slope and soil type.

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Table 2. Risk of water erosion based on slope and tillage regime and associated ABCD management practice classification

Slope	Tillage practice	Associated soil conservation practice	Very stable soils	Stable soils	Unstable soils	Very Unstable Soils
0-4%	Very occasional or irregular tillage > 4 yrs between events; retaining sward e.g. tree crops	Retention of inter-row cover, surveyed row direction to minimise erosion	B	B	B	B
	Zero till controlled traffic systems, with GPS guidance, permanent cover e.g. trash blanket , ground cover	Filter strips, riparian and wetland buffers, constructed wetlands	A	A	A	A
	Regular tillage with impacts reduced by minimising use of rotary hoes, disc cultivators etc.	Inter-row cover, filter strips, riparian and wetland buffers, sediment sumps	B	B	B	B
	Regular Intensive cultivation except in headlands and riparian buffers	Filter strips	C	C	C	C
	Regular intensive tillage up to high bank or wetland boundary		D	D	D	D
5-8%	Very occasional or irregular tillage > 4 yrs between events; retaining sward e.g. tree crops	Retention of inter-row cover, surveyed row direction to minimise erosion	B	B	B	B
	Zero till controlled traffic systems, with GPS guidance permanent cover e.g. trash blanket , ground cover	Filter strips, riparian and wetland buffers, constructed wetlands	A	A	C	D
	Regular tillage with impacts reduced by minimising use of rotary hoes, disc cultivators etc.	Inter-row cover, filter strips, riparian and wetland buffers, sediment sumps, parallel structures	B	B	D	D
	Regular intensive cultivation except in headlands and riparian buffers	Filter strips	C	C	D	D
	Regular intensive tillage up to high bank or wetland boundary		D	D	D	D
8-12%	Very occasional or irregular tillage > 4 yrs between events; retaining sward e.g. tree crops	Retention of inter-row cover, surveyed row direction to minimise erosion (increase soil con measures can increase classification	B	C	C	C
	Zero till controlled traffic systems, with GPS guidance permanent cover e.g. trash blanket , ground cover	Filter strips, riparian and wetland buffers, constructed wetlands, parallel structures	A	C	D	D
	Regular tillage with impacts reduced by minimising use of rotary hoes, disc cultivators etc.	Inter-row cover, filter strips, riparian and wetland buffers, sediment sumps	C	D	D	D
	Regular intensive cultivation except in headlands and riparian buffers	Filter strips	C	D	D	D
	Regular intensive tillage up to high bank or wetland boundary		D	D	D	D
12 -15%	Very occasional or irregular tillage > 4 yrs between events; retaining sward e.g. tree crops	Retention of inter-row cover, surveyed row direction to minimise erosion (increase soil con measures can increase classification	B	C	D	D
	Zero till controlled traffic systems, with GPS guidance, permanent cover e.g. trash blanket , ground cover	Filter strips, riparian and wetland buffers, constructed wetlands, parallel structures	B	C	D	D
	Regular tillage with impacts reduced by minimising use of rotary hoes, disc cultivators etc.	Inter-row cover, filter strips, riparian and wetland buffers, sediment sumps	D	D	D	D
	Regular intensive cultivation except in headlands and riparian buffers	Filter strips	D	D	D	D
	Regular intensive tillage up to high bank or wetland boundary		D	D	D	D
15- 20%	Very occasional or irregular tillage > 4 yrs between events; retaining sward e.g. tree crops	Retention of inter-row cover, surveyed row direction to minimise erosion with increase soil con measures	C	C	D	D
	Zero till controlled traffic systems, with GPS guidance, retention of trash blanket or cover at all times	Filter strips, riparian and wetland buffers, constructed wetlands, parallel structures	D	D	D	D

Note:

Very stable: ferrosols, red basaltic soil; highly permeable

Stable: friable surface soils or medium-coarse sandy soils, sands, sandy loam; highly permeable

Unstable: hard setting surface soils and fine sandy textures (fine sandy clay loam to fine sandy light clay); slowly permeable and often sodic subsoil

Very unstable: hard setting surface soils with and silty textures (silty loam to silty light clay). Surface horizons are low in organic matter, slowly permeable and typically overlie slowly to very slowly permeable, sodic subsoils

3a. Inter-rows maintained with ground cover in plantation (paw paws and pineapples) and tree crops.

Living/dead mulch is a cover crop grown in the inter-row space for non-tree crops (e.g. vegetables, pineapples, strawberries). The options for inter-row cover crops for non-tree crops are as outlined for cover cropping of bare fallow areas. See point *1. Cover crop/ green manure crop on bare fallow* above for some of the options. Inter-row cover for tree crops (e.g. orchards) would include grass species that are not problematic and are shade tolerant like sweet smother grass or carpet grass.

4a. Addressing sediment loss and capture from cultivation zones using grassed headlands and/or grassed/vegetated filter strips and/or grassed drains. Filter strips designed to recommendations for width and height relative to slope and riparian zones

Farm infrastructure can be used to minimise water moving across cultivation to minimise erosion or to reduce the likelihood of water and sediment from cultivated areas moving into wetlands and waterways.

Grassed headlands/waterways/access tracks As inter-rows discharge into these areas they must be able to handle the runoff volume and velocity. Grassed headlands and access tracks can also be designed and managed as waterways. As receiving areas they need to be designed to accommodate the flows / volumes they are likely to receive. Some areas of production area may need to be sacrificed in order to provide enough area to manage runoff from adjacent production areas.

Filter strips and buffer zones work extremely well with grassed headlands/waterways and inter-row cover to control erosion and trap sediment. Ideally, filter strips would be designed to slope, slope length, soil type, and rainfall variables and maintained at 30-50cm height. Some of the production area may need to be sacrificed to provide enough area to capture runoff.

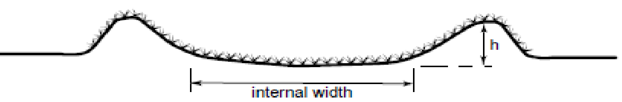
Grassed headlands and filter strips should not be cultivated.

Grassed drains can be used to divert overland flow around cultivated areas as well as collecting runoff from cultivation areas. Maintaining grass or vegetation in the drain will allow sediment to be filtered out. Drains should be wide enough to provide effective drainage and reduce the likelihood of concentrating water flows which can lead to other erosion issues. Drains will require periodic maintenance to remain effective.

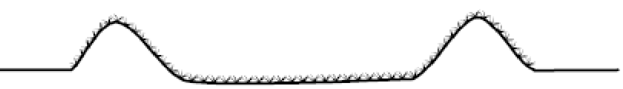
Triangular shaped channels are generally avoided, as they are more likely to erode because of the higher velocities in the V of the channel.

Open drains should be constructed with either (a) parabolic or (b) trapezoidal shape (see below). A flat-bottomed waterway is recommended on land slopes over 5% where a shallow depth of flow is required to prevent excessive velocities.

(a)



(b)



Limited access areas utilising specific access tracks to accommodate the majority of farm traffic will provide further erosion control benefits, particularly if they are managed as a grassed headland where appropriate. This method allows other tracks/ headlands to become limited access (reduced traffic) areas where grass can establish and act as buffered drainage lines.

4b. Overland flow, sediment sumps, erosion controls and legislation

Overland flow refers to water (rainwater or otherwise) that is allowed to follow the path of least resistance which in cropping or row planting systems becomes roadways/headlands and inter-rows. Water flowing from higher land onto and through paddocks should have controls to reduce its erosive power. These controls could be any of or a combination of the following:

- grassed waterways
- drainage lines
- cut-off drains
- diversion banks
- structures that direct water safely around production areas and into dams, sediment sumps, treatment wetlands or through filter strips as suggested above.

In some areas of Southeast Queensland there is legislation that prescribes the size and where in the landscape water storage structures can be built.

Refer to the *Water Resource (Moreton) Plan 2007* for overland flow capture. www.legislation.qld.gov.au/LEGISLTN/CURRENT/W/WatResMorP07.pdf

Levees or diversion banks used to direct flow into dams, or slow it down to increase the amount of water taken would be considered works that passively take overland flow water and would be

Table 3. Suggested widths for grassed filter strips in Southeast Queensland

Intensity[1]	Soil erodibility[2]	Slope[3]	Poor cover[4] Soil loss (t/ha/yr)	Poor cover[4] Suggested filter width (m)	Good cover[4] Soil loss (t/ha/yr)	Good cover[4] Suggested filter width (m)
Medium 800 1300 mm annual rainfall	Medium	Low	8	2	1	2
		Medium	20	13	1	2
		High	37	24	2	2
	Low	Low	8	2	1	2
		Medium	20	13	1	2
		High	37	24	2	2
High 1300 2000 mm annual rainfall	Medium	Low	17	7	1	2
		Medium	41	26	2	2
		High	74	>30	4	2
	High	Low	25	15	1	5
		Medium	61	>30	3	5
		High	112	>30	6	5

1. Intensity is how much rain falls and the energy with which it falls.
2. Soil erodibility is the potential a soil has to erode.
3. Slope: low = 1-3%; medium = 4-7%; high = 8% and greater
4. Cover: poor = less than 30% groundcover; good = more than 80% groundcover

Source: Karssies K, Prosser I.P (1999) Guidelines for Riparian Filter Strips for Queensland Irrigators.

required to comply the provisions of the plan. Sediment sumps are considered structures not built specifically to take overland flow.

Works that passively take overland flow water would be allowed to proceed under section 85(1)(b) of the plan as long as the works had a capacity of not more that **5ML**, and do not have a permanent pump attached. These works are a self-assessable development for the *Sustainable Planning Act 2009* and must comply with the self-assessable code which can be accessed at:

- www.nrw.qld.gov.au/water/management/pdf/code_olf_limit_capacity.pdf
- Other sediment and erosion control information can be sourced at the following websites:
- Freshcare Environmental Code of Practice (Element E3 Land & Soil) www.freshcare.com.au
- Ute Guide: Healthy soils for sustainable vegetable farms (AusVeg) www.ausveg.com.au
- Guidelines for Environmental Assurance in Australian Horticulture Section 5 Land & Soil Management www.horticulturefortomorrow.com.au
- Pineapple Grower s Handbook for Management of Erosion and Sedimentation in Golden Circle Pineapple BMP Manual www.goldencircle.com.au
- Queensland Strawberry Growers Association BMP Manual.
- www.dpi.qld.gov.au/4789_14869.htm
- QPIF *See what s working for South East Queensland growers* fact sheet
- QPIF *Managing Soil Erosion in Vegetables How well am I doing?* fact sheet
- QPIF Agrilink Series (telephone 13 25 23)
- Soil Conservation and Land Management Design Manual - www.derm.qld.gov.au/land/management/erosion/index.html#design_manual

For information on design of **sediment sumps** and **constructed treatment wetlands** and legislation go to:

- www.epa.qld.gov.au/wetlandinfo/resources/static/pdf/FinalReports/EPA08_025_Handbook_web_new.pdf

Table 4. Maximum flow velocities (metres per second - m/s) in catch drains. The maximum flow indicates the upper velocity before the material fails and erosion begins.

Drain Lining Material	Moderate erosion hazard inundation < 6hrs	Moderate erosion hazard inundation < 24hrs
Long term turf reinforced mesh, vegetated	2.7 to 7.0 m/s depending on product specs	2 to 5 m/s depending on product specs
Loose rock 10kg weight each	2.3 to 3 m/s (turbulent flow and normal flow)	
Mesh reinforced turf	2.7	2.0
Kikuya	2.2	1.7
Jute & coir mesh (close weave, bitumen sprayed)	2.0	1.5
Couch, Rhodes grass	1.8	1.4
Bare soil	0.5 (0.3 if highly erosive soil)	0.4

Source: Urban Erosion and Sediment Control for Waterway Health Protection (Nov, 2009) Sunshine Coast Regional Council.

5. Regular tillage occurs on excessive slopes

Low slopes are 1-3%, medium 4-7%, high 8-10% and greater than 10% is deemed excessive. Production on excessive slopes should be avoided as operational and erosion control costs escalate. A comprehensive management plan is required for excessive slopes. Planning needs to incorporate paddock designs to control water and erosion. General farm operations become more difficult with greater wear and tear on machinery and roads. A 4% slope = 1:25, which is gentle sloping terrain.

6. The structural and biological health of soils is monitored

The structural and biological health of the soil can be monitored using the soil health card relative to your crop type. To access soil health scorecards visit www.soilcare.org.au

A very important analysis not provided in the Soil Health Cards is that of soil organic carbon. Organic carbon is the essence of fertility, the lifeblood of the living soil. Organic carbon levels at or above 2% will maintain a healthy microbial workforce. At levels below 1% opportunistic pathogens multiply while beneficial soil microbial populations starve to death.

2. Nutrient management practices for horticulture ABCD framework

1. Soil testing to determine fertiliser program

Soil and plant tissue regimes carried out according to the following guidelines:

- NATA or ASPAC qualified laboratory are used for all tests.
- Regimes as recommended by qualified agronomists, with the appropriate plant part being tested and full rooting depth testing for nutrients.
- In crop testing is carried out proactively and not just in relation to specific crop health problems

As a basis for establishing ***plant tissue*** levels the book *Plant Analysis: an interpretation manual* by Reuter and Robinson is the most comprehensive guide available. It lists most crops grown in SEQ as well as critical levels for many nutrients. To obtain a copy of this book contact CSIRO publishing at www.publish.csiro.au or contact your local library.

The cataloguing details are: Reuter, D.J. & Robinson, J.B. 1997. *Plant analysis : an interpretation manual / editors: D.J. Reuter and J.B. Robinson* CSIRO Publishing, Collingwood, Vic.

Fertiliser application

Fertiliser applications are timed to best match plant nutrient up take requirements, and to minimise chances of nutrient loss due to leaching or volatilisation (a chemical process where nitrogen is released as a vapour into the atmosphere).

Using fertigation where available gives significant efficiencies compared to spreading solid fertiliser products. The main benefit is that fertiliser is immediately available as the soil is wet when it is applied. Fertigation also allows the farmer to apply a little bit often reducing the risk of leaching or run-off during a high rainfall event.

Application rates

Fertiliser spreaders/side dressers should be capable of applying variable rates with adjustment on the fly if possible.

Many fertiliser spreaders can now be linked to paddock yield maps/ soil health maps through GPS technology. Employing this technology can lead to significant savings on inputs and improve productivity of less productive areas.

Calibration of equipment

Fertiliser spreaders/side-dressers etc should be calibrated regularly (at least annually). Regular calibration will ensure that fertiliser can be applied at desired rates.

Fertiliser storage

Incorrectly stored fertiliser/organic inputs represent a significant risk to local waterways. Fertilisers are highly soluble and during rain are quickly transported into the environment. Fertiliser losses through these occurrences also represent significant economic costs.

It is preferable to store fertiliser in a dry, well ventilated shed where environmental losses will be minimal, if this isn t possible it is recommended that fertilisers (including chicken litter) be stored:

- Well away from local waterways
- The product is covered (e.g. tarpaulin)
- The storage site is bunded to capture all run-off
- The ground surface is covered (e.g. via HDPE liner or clay) to prevent leaching

Nutrient budgeting

Nutrient input from other sources are considered:

- Irrigation water is tested regularly (annually) for nutrient content. Consider more regular testing if tail waters are captured for irrigations as the nutrient content maybe more variable than groundwater or creek/river water.
- For organic ameliorants (e.g. chicken litter) a laboratory analysis is supplied with each load.
- The nutrient contribution from other sources (e.g. lab-lab, soy bean) are considered in developing the nutrient budget.

3. Irrigation and drainage management practices for horticulture ABCD framework

2. Irrigation scheduling

Irrigation scheduling may be carried out using tensiometers or C-probe or equivalent equipment.

5a. Irrigation distribution uniformity

Measures of distribution uniformity or system efficiency will have required assessment in the field. With some irrigation systems growers may have measured distribution uniformity themselves via catch cans. Officers from other organisations may also have completed these assessments e.g. Growcom field officers. To access Water for Profit field staff visit www.growcom.com.au

5b. Irrigation efficiency

Measures of water use efficiency in terms of production are difficult in vegetable production due to variability in yield units.

7. Drainage design

For more information on designing drainage systems or managing runoff refer to the following documents: Design Manual for Queensland. See in particular Chapter 8 ***Channel design principles,*** Chapter 9 ***Contour banks***, Chapter 10 ***Diversion banks*** and Chapter 11 ***Waterways***. www.derm.qld.gov.au/land/management/erosion/index

Another source of information is the International Erosion Control Association (IECA), 2008. Best Practice Erosion & Sediment Control (Australasia) www.austieca.com.au

8. Water from washing/packing sheds

There is no specific legislation relating to the handling of waste water from a packing shed. Currently the only legislation that would apply in this case is the general requirement that pollutants not be permitted to enter waterways. Pollutants include soil and nutrients from agriculture. Local councils may or may not have any specific requirements for packing shed water disposal.

In the case of packing sheds that handle root vegetables and potentially large volumes of soil the best practice would generally involve a settling process (e.g. sedimentation ponds). Ideally water would be retained on farm and re-used, however, there may be other risks associated with this such as disease. There may be practices implemented on farm to minimise the amount of soil transported on root vegetables to the packing shed.

4. Pesticide management practices for horticulture ABCD framework

1. Cultural control options for integrated management of pests and diseases

Maintain good farm hygiene to prevent pests coming onto your property and being spread around the farm.

Destroy old crop residues and weeds that can harbour pests and diseases.

Good soil preparation can destroy some insect stages as well as ensure good seedling performance.

Farm planning and layout consider the following:

- Plant new crops upwind of older plantings to reduce pest invasion from older plants.
- High density plantings can make pest management more difficult and good insecticide spray coverage more difficult to achieve.

Keep records to help build a picture of pest and disease occurrence on different parts of the farm and in different seasons. Thereby avoid planting susceptible crops in areas with a history of pests/diseases and select appropriate planting times. Records of methods used to control pests (e.g. insecticide application) and the results (e.g. was the insecticide effective?) can be used to improve practices over time.

Practice crop rotation to avoid the build-up of pests and diseases. Use of a cover crop has the added advantage of improving soil structure.

Practice a production break to break the pest/disease cycle.

Select the production period in order to minimise pests and diseases:

- Select planting times to avoid periods of high pest pressure.
- Crops/varieties grown out of season will be more stressed and more susceptible to pests and disease.
- Grow resistant varieties if feasible.
- Healthy plants are less prone to pest problems ensure good irrigation and fertiliser practices and maintain good soil health; ensure crop varieties are appropriate to local conditions.
- Ensure that transplants are clean and healthy on receipt check for insect pests before planting out.

Consider different irrigation systems:

- Overhead irrigation can increase leaf wetness times and encourage disease and also wash off pesticides if timed incorrectly.
- Furrow irrigation can delay follow up sprays needed to manage a pest outbreak and encourage soil borne diseases.
- Drip irrigation saves water, allows quick crop re entry after watering and does not wet plant leaves.

Monitor the crop regularly to determine:

- If chemical control is necessary are pest numbers above the economic threshold for the crop and crop stage? Are natural enemies present and in what numbers?
- Which insecticide is appropriate.
- When to spray.
- Whether a spray was effective.

Encourage natural enemies:

- Avoid broad-spectrum insecticides.
- Provide food (e.g. flowering plants) and shelter (e.g. beetle banks).
- Supplement by buying natural enemies from a commercial source.
- Mechanical controls such as insect barriers and traps can help reduce pest levels.

Source: Lara Senior, Entomologist, Agriculture, Food and Tourism and Regional Services, DEEDI

2. Pesticide timing, type and rotation

The use of softer more selective chemistry is preferred where possible, however, rotation of chemistry is also a component of chemical pest management and is required to minimise resistance development. Therefore, the use of some broad-spectrum pesticides will be required to adequately rotate chemistry for resistance management. Residual and persistent products also have a role depending on the situation as the longer the residual activity the fewer chemical applications required.

4. Pesticides applied as prescribed

Chemical labels contain a range of information and recommendations for application that must be adhered to as the label is a legally binding document. Chemical labels may contain recommendations on weather conditions, droplet size, nozzle types, storage and disposal and water rates.

5. Chemical storage

The Queensland Government has produced the Agricultural chemical user s manual. www.dpi.qld.gov.au/4790_5044.htm

It contains information on all aspects of agricultural chemical use including recommendations for storage. The classification of the chemicals may also be associated with different storage requirements e.g. for dangerous goods.

For more information see the Dangerous Goods Safety Management Act and Regulation at;

www.deir.qld.gov.au/workplace/chem/legislation/index.htm

There may be requirements that any bunding has the ability to hold a certain percentage of the chemical stored.

6. Spray equipment calibration

Spray equipment should be maintained and regularly calibrated including the nozzles as these can become worn. Spray efficacy and therefore the effectiveness of the spray application may be dependent on how well the spray equipment is maintained.

Queensland Government

For further information contact:
DEEDI Business Information Centre
13 25 23 (weekdays 8 am to 6 pm)
Email: callweb@dpi.qld.gov.au
www.healthywaterways.org