

Healthy Country

managing the land for healthy waterways

FarmFLOW

growth through good practice

Optimising nitrogen fertiliser use efficiency in vegetables

Putting in place practices for sustainable nutrient management

Rising input costs are driving horticultural industries to be more efficient in their use of inputs. Nitrogen fertiliser is one such input. Maximising the use of applied nitrogen is the best way to maintain or improve yield while making sure that fertilisers are used efficiently and sustainably. The following provides information on practices that can be put in place to optimise nitrogen fertiliser efficiency, reduce costs and the risk of off-farm losses. Following these practices will improve the efficient use of all applied fertilisers—not only nitrogen fertiliser.

Efficient nitrogen programs

A nitrogen fertiliser program for vegetables should aim to:

- replace nutrients removed in harvested product
- consider unused fertiliser including crop residues and unharvested produce that is returned to the farming system
- include strategies and practices to reduce the risk of losses from the farming system.

How can you maximise nitrogen use efficiency and minimise losses

Optimise fertiliser application

There is a range of management practices that can be put in place to make sure that the use of applied nitrogen is maximised. Table 1 can be used as a self assessment to see where the efficiency of nutrient programs could be improved.

Irrigation management

Good irrigation management is critical to fertiliser management. Over irrigation may leach N below the root zone. Where there are salinity problems, irrigation is a balancing act between leaching salts while keeping nitrates in the root zone. Soil moisture monitoring tools such as tensiometers and C-probes can help you apply water to optimal root zone moisture or effectively manage salinity.

If a leaching fraction is needed then use this strategy at times when crop fertiliser use is low. Water quality monitoring may also identify nutrients in irrigation water that should be counted in your fertiliser program.

Minimise erosion potential

Surface erosion results in the loss of productive topsoil including nutrients. Providing soil cover is the most effective option to reduce soil loss. However, there are a range of practices at the field and farm scale that can be put in place to reduce soil erosion.

Recent trials in the Lockyer area indicate that under bare fallow up to 6 tonnes of soil per ha can be moved from a field in a single rain event.

In field

- Fallow management: plant cover crops during high risk rainfall periods. These protect soil from raindrop impact and slow run-off while roots stabilise the soil. Where possible provide inter-row (furrow) cover as run-off is concentrated into furrows and are a likely area for erosion as well as transport of soil moved from beds. Inter-row cover can be planted in commercial crops during high risk periods.
- Implement minimum tillage and/or controlled traffic practices. Tillage results in a loss of soil structure increasing erosion risk. Controlling machinery traffic provides an opportunity to minimise tillage.

Farm design and infrastructure

- Farm drains and drainage lines should be vegetated to trap and filter sediment. Vegetated filter strips should also be in place between fields and waterways or wetlands.
- Sediment traps/ponds can be put in place to capture run-off and soil before it moves off farm. These can also be used to filter wash water from washing and packing sheds before re-use.
- Sediment traps and drains will require maintenance to remain effective.

Healthy Country partners:



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Table 1. Activities to optimise fertiliser application for improved efficiency.

Activity	Comments	Currently in place Yes/No/NA
Set a realistic target yield	Be realistic about yield targets and apply fertiliser rates accordingly. Yield and plant nutrient uptake are directly related. Factors that effect yield will reduce nutrient uptake eg disease, environmental factors. Unused nutrient will then be available for future crops. Unless deficient in N, higher fertiliser rates are unlikely to increase yield, but may increase the risk of losses and have a negative effect on product quality.	
Regular soil testing	Use soil testing to check soil nutrient status and inform your fertiliser program. Testing should occur regularly rather than when you suspect a problem. Identify nutrients that could be limiting crop growth. If crop growth is limited by other nutrients then applied nitrogen will not be used by the plant and could be lost.	
Crop removal	Fertiliser rates should consider N removed in harvested product and what is put back into the system through crop residues and unharvested product. Aim to replace the nitrogen removed in harvested product. Crop removal rates and the amount of crop residue vary between crops. For example, sweet corn has lots of residue while most of the lettuce plant is removed with very little residue. In crops where there are a lot of residues, the residues are quickly broken down to release nitrogen.	
Timing of application	Reduce the time between fertiliser application and planting. The longer that nitrogen is in the soil without being used by the plant the greater the risk of loss.	
Time applications to plant needs	Split fertiliser applications. Applying full fertiliser rates up front increases the risk of leaching or surface erosion losses. N should be applied in small amounts, frequently. Approximately one third of nitrogen requirements should be applied as base with the remainder in split applications.	
Placement of fertilisers	Consider the placement of fertilisers. Banding applies nutrients where plants will use them. It is more efficient, cost effective and sustainable.	
Method of application	Fertigation or micro irrigation systems provide greater precision in fertiliser application.	
Field history	Consider previous crop performance. Did you reach target yield? If you had a crop plough in then take into account fertiliser that is still in the system.	
Rotation	Include legumes in the rotation to supply some of your nitrogen needs. This will also increase organic matter and soil organisms. Storing more soil carbon will hold more N in the soil in a stable form	
Fertiliser formulation	Consider using controlled release fertilisers which delay the release of nitrogen to better match plant use and reduce risk of losses. The benefits of these may vary with crop and soil type. It is best to trial these products on a small area.	
Product quality	Excess nitrogen can cause quality problems in harvested product. Monitor product quality to check your nitrogen rates are optimal.	

What do I need to know for efficient nitrogen use decisions?

Vegetable production relies on nitrogen inputs. Growers should consider the following questions when making nitrogen fertiliser decisions:

- How much available nitrogen is in my soil?
- How much did my previous crop use? Did it reach target yield?
- What is my target yield for my next crop and how much nitrogen will it need?
- Did I have a crop failure or plough in previously?
- Did I use a legume in my rotation previously?
- Are there more efficient and cost effective ways for me to apply my fertiliser?
- What are the risks of losing nitrogen from the system? Leaching? Erosion? Gaseous? How can I reduce the risks?
- How are my farming practices affecting soil organic matter, soil organisms and the nutrient cycle in my soil? Can I reduce negative effects?

More information

Bagshaw, J. (2007). 'Managing soil erosion in vegetables: see what's working for South East Queensland growers', DEEDI.

Bagshaw, J. (2007). 'Managing soil erosion in vegetables – How well am I doing?' DEEDI.

Cotton Catchment Communities CRC (2008) On Farm Series: Nitrogen Losses http://www.cottoncrc.org.au/content/Industry/Publications/AgronomyNutrition/Other_Nutrition_Documents.aspx

Department of Agriculture, Fisheries and Forestry (2010) Soil Health Knowledge Bank Soil Fertility <http://www.soilhealthknowledge.com.au/>

NSW Department of Primary Industries (2010) Best Crop Fertilisation Practices <http://www.dpi.nsw.gov.au/agriculture/horticulture/vegetables/popular/best-practice>

Vegetables WA (2010) Nutrient management <http://www.vegetableswa.com.au/goodpractice.asp>

Dalal, R.C., Wang., W.J et al (2003) 'Nitrous oxide emission from Australian agricultural lands and mitigation options: a review' Australian Journal of Soil Research 41 (2): 165:195

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