

Making the most of your Nitrogen

Nitrogen (N) is an essential nutrient for plant growth, development and reproduction, so it's important to ensure your crops have enough! However, you also want to make sure that too much nitrogen is not applied as this increases production costs and can result in leaching and run-off.

So how do you make sure you apply the right amount? Nitrogen fertiliser rates are influenced by the crop to be grown, yield goal, weather and quantity of nitrogen provided by the soil. This factsheet provides guidelines to assist you in making site-specific decisions about applying nitrogen fertiliser.

The steps to providing the right amount of nitrogen are shown below and discussed on the next page.

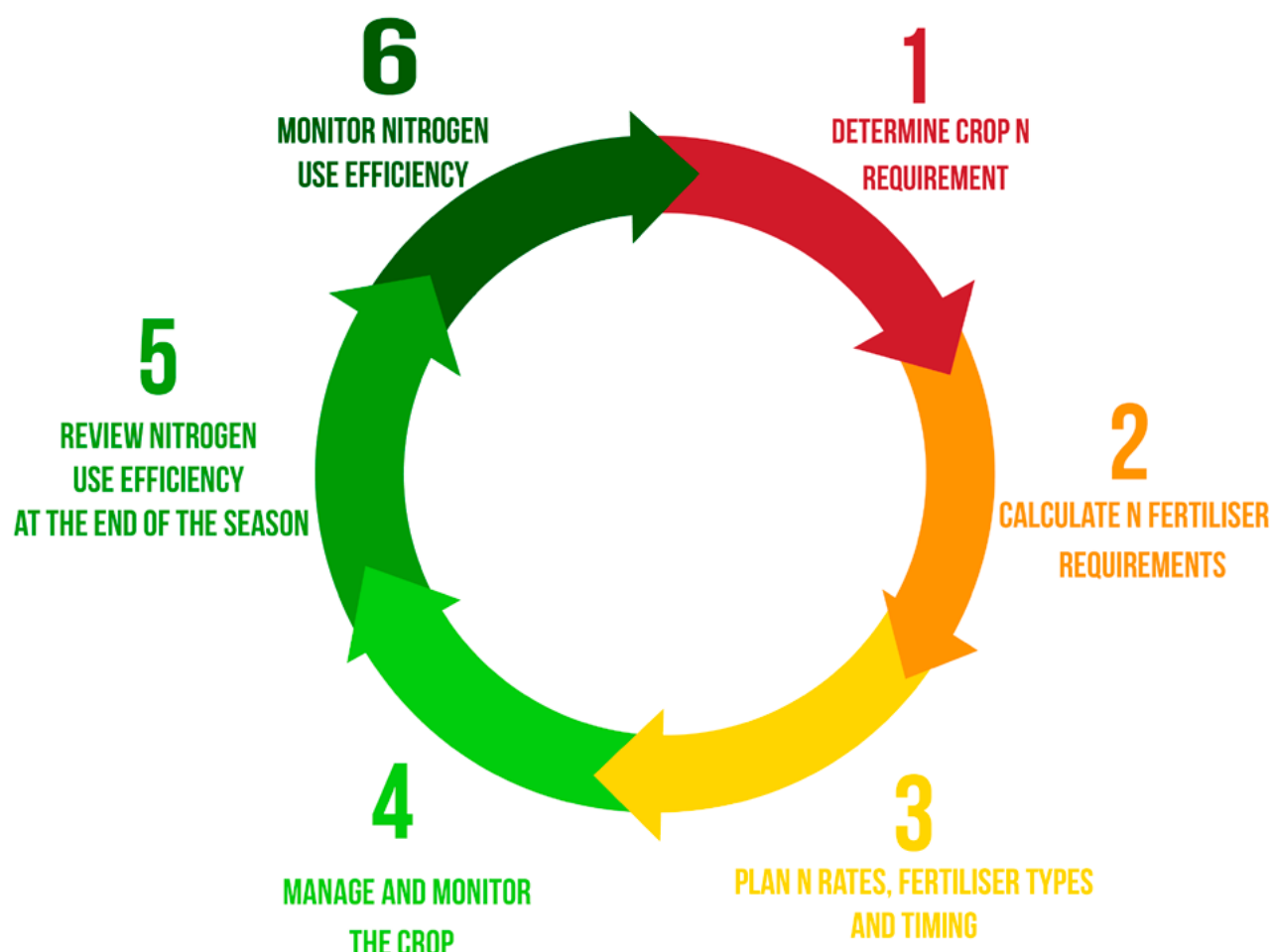


Figure 1: Nitrogen management and monitoring cycle
(Tas Farming Futures - <http://www.tasfarmingfutures.com.au>)

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Managing and monitoring N

1. Determine crop N requirements

You can calculate the expected total N removal based on crop type and target yield. The amount of N typically removed by a number of vegetable crops is outlined in Table 1. However, you should also consider crop recommendations or previous experience to make sure you apply enough N.

Table 1 - Nitrogen removal figures

CROP	N (KG/TONNE)
Bean Green	4.0
Broccoli	4.5
Cabbage (Dutch)	3.0
Capsicum	3.0
Carrot	2.0
Cauliflower	4.0
Celery	3.5
Cucumber	1.0
Lettuce	3.0
Lettuce (Oakleaf)	2.5
Pea Green	5.0
Pumpkin	1.8
Spinach	4.2
Sweetcorn	4.0

Establish realistic crop yield expectations for each crop/field based on soil properties (including soil structure and condition), available moisture/water, yield history, and management level. You can also allow a reasonable increase (e.g. 5%) for good management and growing conditions.

2. Calculate the N fertiliser requirements

Vegetable crops absorb N from the soil as both Ammonium (NH_4^+) and nitrate (NO_3^-). However, most of the N is taken up as nitrate.

The N fertiliser requirement depends not only on the crop requirements but also the total N already available to the crop:

- Estimate the residual soil N. Use a soil nitrate test (N-check) at pre-planting, collecting soil samples to rooting depth (0-30cm) and (30-60cm for deeper

rooting crops). You may need to convert the results to kg N/ha.

- Consider mineralisation (from soil organic matter and previous crop residues). Take appropriate credit for previous legume crops or compost used in the rotation.
- Account for any N applied in a pre-plant fertiliser (if not already accounted for), contributions from phosphorus fertilisers such as MAP and DAP or other mixed or composite fertilisers containing N.
- Account for nitrate N in water (if levels above 10 mg/L are expected). Test irrigation water for nitrate content and account for N accordingly if you expect elevated levels.

Allow for an N 'buffer' to remain in the soil after harvest. This should not be greater than 50 kg N/ha for vegetables.

3. Develop a plan for N rates, fertiliser types and timing

Aim to match timing with crop needs using split applications. When applying N follow the 4 R's:



Image courtesy of the Fertiliser Institute.

4. Manage and monitor the crop

Monitor soil N and sap N and adjust the N fertiliser plan as required. Monitor N uptake into the crop using sap tests (such as the NU test, not using hand held instruments) or check N accumulation using tissue tests.

Sap tests are best started in the first quarter of the growing season to allow for correction of deficiencies. Plant analyses can provide information on all nutrients not just N.

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5. Review Nitrogen Use Efficiency (NUE) at the end of the season/crop

After harvest, calculate the nitrogen use efficiency (NUE), which is expressed as a percentage. NUE provides an insight into potential N losses by calculating the amount of applied N removed from the system by the harvested part of a crop. A straightforward method to determine NUE is the partial nutrient balance, which is calculated as follows:

$$\text{NUE\%} = \text{N removed/N applied} \times 100$$

N removed (kg/ha) = all parts of the crop that are harvested and removed e.g. plant residue

N applied (kg/ha) = N input from fertilisers water and amendments

An example of a partial nutrient balance for N is provided below:

	CROP	
Inputs	Spring lettuce (kg/ha)	Summer broccoli (kg/ha)
Fertiliser	250	370
Organic amendments	0	20
Irrigation water NO ₃ -N	34	45
Total N applied	284	435
Outputs		
Crop N uptake	157	371
Removal in harvest	79	112
Total N removed	236	483
NUE%	83%	111%

If the NUE is low (<60-70%), identify why. Refer to 'How can NUE data be interpreted?'. A NUE calculator is available from <http://www.tasfarmingfutures.com.au>

6. Monitor NUE

Keep records and monitor paddock and rotation NUE over time, adjusting your approach as required. This is useful for planning and assessing any management changes that you implement.

How can NUE data be interpreted?

The sustainable NUE for a specific crop will depend on the type of crop, harvest index, the previous crop and how they fit into the rotation. The % figures we give here for NUE provide a rough guide only.

A high NUE of >100%, indicates that more N is being removed than is being applied and the plants access N from the 'organic pool' or residual N from fertiliser applications to a preceding crop. Depleting the 'organic pool' can result in nitrogen deficiencies at a later stage, if not replenished.

A low NUE of say <60-70% (depending on crop) indicates that less N is being removed than has been applied; applied N is left in the soil and may be lost. As a 'rule of thumb' residual available nitrogen in the soil after harvest should not exceed 50 kg/ha for vegetables. If NUE is low it could indicate excessive use of fertilisers or issues with crop health i.e. the crop has not grown to potential due to lack of water or pests or diseases, so that a standard fertiliser program provided too much N.

Please note there is a significant amount of documentation, references and corresponding research results that support these suggestions. **Please discuss these suggestions and your nitrogen fertiliser plan with your agronomist.**

Where can I find more information on managing nitrogen?

- **Soil testing and Interpretation for Vegetable Crops – Doris Blaseing, RMCG**
<http://www.soilwealth.com.au/resources/fact-sheets/soil-nutrition-and-compost/soil-testing-and-interpretation-for-vegetable-crops-a-guide/>
- **Quick guide to farm nitrogen sources – Doris Blaseing, RMCG**
<http://www.soilwealth.com.au/resources/fact-sheets/quick-guide-to-farm-nitrogen/>