



Chapter 1

Fert\$mart Planning

CONTENTS

1	Fert\$mart planning	1-2
1.1	Situation analysis.....	1-3
1.1.1	Know the feeding system.....	1-4
1.1.2	Know farm production goals and feed requirements	1-4
1.1.3	Access information for the nutrient budget.....	1-4
1.1.4	Map farm soil types.....	1-4
1.1.5	Map farm management zones.....	1-5
1.1.6	Collect soil samples	1-5
1.1.7	Assess soil condition	1-5
1.1.8	Assess pasture condition.....	1-5
1.1.9	Determine the fertiliser financial budget.....	1-6
1.1.10	Consider contractors, labour, equipment and skills	1-6
1.1.11	Consider animal health issues.....	1-6
1.1.12	Consider infrastructure, equipment and management.....	1-6
1.2	Identify potential and limitations	1-6
1.2.1	Determine if goals are realistic	1-7
1.2.2	Identify gaps in knowledge, skills and practices	1-7
1.2.3	Shortlist the options	1-7
1.3	Identify soil and nutrient related issues.....	1-7
1.3.1	Identify soil issues.....	1-7
1.3.2	Identify irrigation water quality issues.....	1-7
1.3.3	Identify limiting crop/pasture condition issues.....	1-7
1.3.4	Identify farm-scale nutrient issues and options	1-8
1.4	Interpret data and prepare draft nutrient plan	1-8
1.5	Finalise the nutrient plan	1-8
1.6	Implement the nutrient plan.....	1-9
1.7	Monitoring and review	1-9
1.7.1	Fine-tuning (2-6 months)	1-9
1.7.2	Annual review (Year 2)	1-9
1.7.3	Future reviews (Year 3)	1-9
1.8	Fert\$mart Planning Checklist	1-10
1.9	References	1-14



1 Fert\$mart planning

The Fert\$mart Planning Cycle (Figure 1.1) was developed primarily as a guide for farm advisors to step through the planning process and to prepare a soil and fertiliser management plan for dairy farmers. It can also be used by dairy farmers who have a sound understanding of agronomy and soil fertility. The process consists of seven steps designed to be repeated annually to update and fine-tune fertiliser management, and it brings together information from all other chapters in this manual. The process aims to make fertiliser more profitable by managing soil condition and the targeted use of fertiliser.



Figure 1.1 The Fert\$mart Planning Cycle

Fert\$mart planning recognises that crop and pasture production is often limited by factors other than soil fertility, and consequently the following steps have been developed to ensure fertiliser decisions are made in the context of the whole farm system.

- **Step 1: [Situation analysis](#)** - Focuses on understanding the farm business, the current farming system, resources (water, soils, nutrient sources, pastures and crop), infrastructure and management.



- **Step 2: [Identify potential and limitations](#)** - Checks that farm production goals are realistic, given there may be limitations other than nutrients. This step also identifies any gaps in knowledge and skills, and shortlists management options best suited to the farm and farm business.
- **Step 3: [Identify soil and nutrient related issues](#)** - Focuses purely on soil and nutrient related issues. Soil tests and field observations are used to narrow down which factors are limiting production and need to be managed.
- **Step 4: [Interpret data and prepare draft nutrient plan](#)** - The information from all previous steps is interpreted and used to prepare a draft soil and nutrient management plan.
- **Step 5: [Finalise nutrient plan](#)** – Practical aspects of the draft plan are checked and finalised.
- **Step 6: [Implement nutrient plan](#)** – Nutrient management plan is implemented.
- **Step 7: [Monitoring and review](#)** – Monitoring and review is on-going. Fine-tuning the plan may be required within 2-6 months depending on crop/pasture/milk production performance. In year 2 the planning cycle begins again, however soil testing may not be required. In year 3 soil tests are carried out across the farm to check soil fertility levels and trends.

1.1 Situation analysis

Fertiliser planning requires a good understanding of the farm and business. For best results, farmers work with their advisor to; discuss production information, inspect the paddocks, note the condition of soils and pastures, and carry out soil sampling. The following aspects of the farm business are all important to nutrient management and fertiliser decisions:

- Farm production goals
 - [Know the feeding system](#)
 - [Know farm production goals and feed requirements](#)
 - [Access information for the feed budget](#)
- Physical resources
 - [Map farm soil types](#)
 - [Map farm management zones](#)
 - [Collect soil samples](#)
 - [Assess soil condition](#)
 - [Assess pasture condition](#)
- [Financial resources](#)
 - Determine the fertiliser financial budget
- [Human resources](#)
 - Consider contractors, labour, equipment and skills
- [Animal health issues](#)
- [Infrastructure and management](#)

The following steps (1.1.1 to 1.1.13) explain the information needed for the situation analysis, and a well-informed fertiliser plan.



1.1.1 Know the feeding system

Knowledge of the feeding system is important to understanding farm nutrients. There are five feeding systems commonly used on Australia dairy farms ([Dairy Australia, 2012](#)):

1. *Pasture + other forages + low grain/concentrate feeding in bail* (i.e. Grazed pasture + other forages + up to 1.0 tonne grain/concentrates fed/cow/year in the bail).
2. *Pasture + other forages + moderate-high grain/concentrate feeding in bail* (i.e. Grazed pasture + other forages + more than 1.0 tonne grain/concentrates fed/cow/year in the bail).
3. *Pasture + partial mixed ration ± grain/concentrate feeding in bail* (i.e. Pasture grazed for most or all of year + partial mixed ration on feed pad ± grain/concentrates fed in bail).
4. *Hybrid system* (i.e. Pasture grazed for less than nine months per year + partial mixed ration on feed pad ± grain/concentrates fed in bail).
5. *Total Mixed Ration (TMR) system* (i.e. Zero grazing. Cows housed and fed total mixed ration).

In feeding system 1, dairy cows spend most of the time grazing pastures and therefore returning or recycling most nutrients to the paddocks. On the other hand, in feeding system 5, all nutrients are deposited on or near the feedpad/dairy and are then stored, distributed or sold. It is important to understand the feeding system and what happens to nutrients imported in feed when developing the nutrient budget.

[More on nutrient stores & transformations \(Chapter 10.2.2\)](#)

1.1.2 Know farm production goals and feed requirements

Production goals start with the volume and quality of milk required throughout the year. This determines the number of milkers, the herd size, and the feed requirements.

Feed is the largest cost for most dairy farmers. Growing and utilising more home-grown feed helps to keep farm costs down and improve profitability. Fertiliser plays an important role in achieving this. A [feed budget](#) can be used to work out the home-grown feed requirements and the dry matter (DM) production goals for the coming year.

If DM production goals are similar to the previous year, these figures can be used in the farm nutrient budget to work out what quantities of nutrients need to be brought onto the farm to maintain current production levels. Soil tests are also required to adjust the specific fertiliser requirements for each farm management zone (FMZ). A FMZ is a group of paddocks with similar soil types and management (See [Chapter 15.4.1](#)). Where nutrients are removed in product (e.g. silage, hay and crops) both a paddock/FMZ nutrient budget and soil tests are required to work out the fertiliser requirements. Crop types and estimated yields (kg DM/ha) are also required for the nutrient budget.

1.1.3 Access information for the nutrient budget

The nutrient budget is used in Step 4 (see [Section 1.4](#)) to work out farm fertiliser requirements. The first step in nutrient budgeting is to quantify the amount of nutrients coming on to, and leaving the farm, and this requires access to the farm records. The inputs required for the nutrient budget are described in [Chapter 15.6](#).

1.1.4 Map farm soil types

Knowing the soil types and where they are located across the farm is an important consideration for soil and fertiliser management. Regional soil maps are useful in identifying and describing soil types on a broad scale. Regional maps can be used in combination with the farmer's existing knowledge



of the farm soil types to produce a soil map at a paddock scale. The soil map is used to characterise the soil profile, properties, behaviour and suitability for crops and pastures. Soil information is used in steps 1.2 and 1.3.

[More on Regional Soil Types \(Chapter 6\)](#)

[More on Soil Properties \(Chapter 4\)](#)

1.1.5 Map farm management zones

Fertiliser use is more targeted and profitable when fertiliser recommendations are customised for each FMZ. The farm map, showing paddocks and soil types, is used in combination with previous soil tests and previous/current management to map the FMZs.

[More on FMZs \(Chapter 15.4.1\)](#)

1.1.6 Collect soil samples

If the farm soil tests are more than 2 to 3 years old, collect a new soil sample from each FMZ. At least 30 soil cores are required for each sample. Cores should be taken along monitor lines or transects that you can come back and resample in one or two years, or collected randomly across the area. In each case, however, care should be taken to avoid areas where nutrients may be concentrated such as dung and urine patches, areas near gateways, water troughs, and stock camps.

Take the samples to the standard depth (0 - 7.5cm in Tasmania, 0 - 10cm in all other states). Keep the samples cool (not on the back of the ute) and send them to a NATA accredited or ASPAC certified soil testing laboratory as soon as possible. Soil samples should be sent to the same soil testing laboratory each year to ensure consistency of soil testing methods.

[More details on soil sampling \(Chapter 8\)](#)

1.1.7 Assess soil condition

Fertiliser efficiency can be limited by soil constraints; however it can also be improved with better soil condition. A quick field assessment of soil condition in each FMZ can pick up issues not identified in the soil tests, and farmers should alert their advisor of known soil issues. Look for evidence of poor soil surface condition, slaking, dispersion, compaction, waterlogging, salinity and acidity. See the Fert\$mart [FMZ field sheet](#) for a basic checklist for soil condition assessment. Chapters 4 to 7 of this manual discuss soil condition

1.1.8 Assess pasture condition

Poor pasture performance and utilisation also reduces fertiliser efficiency. Pasture condition in each FMZ should be assessed and recorded. Observe current pasture species composition and consider their suitability (see [Chapter 15.5.1](#)). This can be carried out at the same time soil samples are taken in each FMZ:

1. Visually assess the species.
2. Consider recent performance/production of the paddock, grazing interval, silage/hay production.
3. Assess weed types and density.

Look for changes in species, growth and colour in urine and dung patches compared to the pasture around them. Look carefully at the old and fresh dung patches and record observations.



[More on assessing perennial ryegrass condition](#)

[More on visual symptoms of nutrient deficiencies \(Chapter 8.6\)](#)

1.1.9 Determine the fertiliser financial budget

The farm fertiliser budget will vary from year to year, depending on financial circumstances. A common strategy is to maintain soil fertility when finances are tight, and to apply additional nutrients to meet capital requirements (if required) in the better years (see [Chapter 15.3](#)). Farm fertiliser records are a useful starting point.

1.1.10 Consider contractors, labour, equipment and skills

Implementation of the fertiliser plan could be limited by contractors, farm labour, equipment and skills. For example; if contractors are used for fertiliser spreading, does this create any limitations on the fertiliser types, rates and blends used across the farm, and the timing of applications? Also consider distribution accuracy and the impact this has on fertiliser use efficiency. For more information on the accuracy of fertiliser spreaders refer to the [Fertilizer Australia](#) website, or download the [Fertcare Accu-Spread PDF](#).

1.1.11 Consider animal health issues

Check for animal health issues linked to soil and plant nutrition or toxins. See the following links:

[Nitrate poisoning \(Chapter 12.6.1\)](#)

[Grass Tetany](#)

[Implications on transition cow management](#)

[Trace element deficiencies \(Chapter 3.5\)](#)

1.1.12 Consider infrastructure, equipment and management

Check the capability of existing handling and spreading equipment. Are there limitations to fertiliser use, e.g. the types, rates, placement and timing? Are there cost effective options to upgrade infrastructure/equipment to improve fertiliser efficiency, e.g. effluent distribution equipment or infrastructure?

Are there other aspects of farm management that can be improved? The following links will help to identify key areas for improvement:

[Soil management](#)

[Fertiliser management](#)

[Effluent management](#)

[Irrigation management](#)

[Feed conversion efficiency](#)

[Pasture Consumption and Feed Conversion Efficiency Calculator](#)

1.2 Identify potential and limitations

The purpose of this step is to consider the farm business and to determine if the production goals are realistic, and to identify opportunities where improved knowledge and skills will benefit soil and



fertiliser management. The aim is to shortlist the options that will help to achieve the production goals.

1.2.1 Determine if goals are realistic

Use production records and other information gathered in the situation analysis to check the farm production goals. Compare goals with what has been achieved on other local and regional farms (e.g. data from focus farms, case studies or demonstration sites). Also consider the capability of the farm and of the capacity of the business (i.e. knowledge, skills, equipment, labour resources, physical resources, financial resources and current management practices).

1.2.2 Identify gaps in knowledge, skills and practices

Compare current management with acceptable practices in the DairySAT checklists for [soils](#), [fertiliser](#), [effluent](#) and [irrigation](#) management. Are there any gaps in knowledge, skills, or farm practices that if addressed will result in better soil condition and/or fertiliser use? Check for research data that is relevant to the situation, and incorporate where appropriate.

1.2.3 Shortlist the options

Shortlist the options for improvement to knowledge, skills and practices, and revise production goals if necessary.

1.3 Identify soil and nutrient related issues

Before considering the plant nutrient requirements, it is important to identify if there are other soil and nutrient related issues. There could be limiting factors (other than nutrients) that need to be addressed to get the best value out of fertilisers. Some factors cannot be changed economically (e.g. highly sodic or saline soils) and land use and production goals in these areas need to be matched accordingly. Farm scale nutrient efficiencies are also considered in this step. Are there opportunities to use nutrients more strategically across the farm, e.g. better distribution of effluent?

1.3.1 Identify soil issues

Limiting factors can be identified using field observations described in [Sections 1.1.7](#) and [Section 1.1.8](#) in combination with the soil tests. Some factors can only be observed in the field (e.g. compaction, pugging, and waterlogging) while others may show signs in the field, but need to be confirmed with soil tests (e.g. salinity, sodicity and acidity). Chapters 4 to 7 of this manual discuss soil issues. Now work out cost effective management options where they exist. It may be necessary to prepare a program and budget to remedy these over a longer time period.

1.3.2 Identify irrigation water quality issues

Poor quality irrigation water can be harmful to crops, soil and irrigation equipment. This can result in lower production and poor fertiliser use efficiency. Check the water analysis for the five salinity and sodicity criteria.

[More on irrigation water quality](#)

1.3.3 Identify limiting crop/pasture condition issues

Production can also be limited by crop and pasture condition (e.g. species, plant population, diseases, pests and weeds). Crops and pastures in good condition and suited for the purpose will use soil nutrients more efficiently than unhealthy and weedy stands. See [Chapter 15.5.1](#) for more on species suitability.



1.3.4 Identify farm-scale nutrient issues and options

Prepare a farm nutrient budget (See [Nutrient Budgeting, Chapter 15.6](#)) to work out the quantities of nutrients coming onto, and leaving the farm. The nutrient budget will show whether there is a whole farm nutrient surplus or deficit. Phosphorus, potassium and sulphur are generally accounted for in the nutrient budget. In situations where a nutrient surplus exists there may be an opportunity to treat areas more strategically and reduce nutrient costs. This could apply to both fertiliser and effluent treated areas on the farm. When nutrients exported from the farm in produce exceed nutrients brought onto the farm, the deficit can be used to estimate the total nutrient requirements to maintain production.

It is also important to look for nutrient build up areas and cease further applications of nutrients already in abundance. [Nutrient maps](#) provide a good visual comparison of nutrient levels across the farm. Alternatively, nutrient levels in each paddock/FMZ can also be compared with the soil fertility guidelines using a graph or table (See [Chapter 15.10](#) and [Chapter 16.2.3](#)).

This information also helps to identify which FMZs will benefit most from the dairy effluent, provided it is practical to get the effluent onto that area of the farm. Estimate the quantity of effluent produced each year, and the nutrient composition to work out its value. Estimating the dollar value of effluent (equivalent fertiliser cost) helps to justify any additional costs required to use effluent more strategically around the farm. Explore cost effective options to improve effluent distribution - See [Chapter 13](#), 'Using Dairy Effluent'.

For more information on retaining and optimising nutrient use on dairy farms refer to [Chapter 10, Keeping Nutrients on Farm](#).

1.4 Interpret data and prepare draft nutrient plan

See [Chapter 16](#) for details on how to develop and document a fertiliser management plan using the 4Rs framework.

1.5 Finalise the nutrient plan

Check that the recommendations in the draft plan are feasible, practical and affordable as outlined below:

- Involve members of the farm business and the farm advisor in a face-to-face meeting. Discuss soil test results (graphically if available) by considering current levels in comparison with the optimal test value/range. Discuss/consider soil fertility trends, if previous soil test data is available.
- Check the management options are best suited to the farm and the farm budget.
- Discuss/consider the nutrient program costs and the economics, for instance a staged nutrient build-up plan.
- Check the 4Rs fertiliser plan is practical and compatible with farm infrastructure, machinery and management (i.e. fertiliser type, rate, place, time and frequency).
- Discuss/consider implementation of the plan, record keeping and monitoring crop/pasture performance in the next 2-6 months, and then beyond that time.
- Finalise the nutrient management plan.



1.6 Implement the nutrient plan

Implementation of the nutrient management plan requires the farmer to:

- Follow the 4Rs fertiliser program and other strategies in the nutrient management plan (where practical and affordable).
- Record the actual management decisions; sources, rates, placement and timing (including frequency) for each fertiliser application, and note the reasons for changes to the plan (e.g. weather conditions, product or contractor availability).
- Refer to DairySAT checklists for managing soils, fertiliser, effluent and irrigation.

1.7 Monitoring and review

1.7.1 Fine-tuning (2-6 months)

The farmer closely monitors pastures, crops and livestock performance, noting any issues and discussing these with their advisor. A visit from the advisor may be beneficial 2-6 months after starting the fertiliser program to assess pastures, crops and stock and to discuss/note current production and yields (milk, crop and pasture production/consumption). Further soil and/or tissue tests may be required to diagnose nutrient related issues if problems are observed in the crops and pastures.

1.7.2 Annual review (Year 2)

An annual review (may also be half yearly, or at the end of a crop cycle) provides opportunity to:

- Discuss/consider the fertiliser program and the records of fertilisers used in each FMZ.
- Visually assess crops, pasture and livestock, and consider the performance throughout the year/season. Has the performance met expectations? Have any problems been observed? If no problems have been observed, and production is meeting expectations, further soil/tissue testing may not be required in year 2.
- Redo the nutrient budget to check nutrient surpluses/deficits for the farm or FMZs.
- Work out maintenance fertiliser requirements for the farm and FMZs.
- Refer to previous soil tests and introduce capital fertiliser applications where required and if finances permit.
- Update the 4Rs fertiliser program for the coming year/season.

1.7.3 Future reviews (Year 3)

Every 3 years carry out soil testing in every FMZ then repeat the steps described in the Situation Analysis (Section 1.1) and update the 4Rs fertiliser program. An important part of the year 3 review is to check soil fertility trends in each FMZ against the guidelines. Soil fertility trends provide important feedback that can be used to fine-tune maintenance requirements, and help to keep soil fertility on track over the long term - See [Chapter 16](#).



1.8 Fert\$mart Planning Checklist

The following checklist provides a summary of the steps involved in Fert\$mart Planning along with the tools and knowhow that are available to undertake each step.

1. Situation Analysis		Print checklist
Steps - Production Goals	Tools	Knowhow
1.1 Understand the feeding system	➤ Farm data collection sheet	➤ Feeding systems
1.2 Know farm production goals and feed requirements		➤ Feed budgets
1.3 Access information for the nutrient budget		➤ Nutrient budgets (Chap 15) ➤ Nutrient stores & transformations (Chap 10)
Steps - Physical Resources	Tools	Knowhow
1.4 Map farm soil types	➤ Field data collection sheet ➤ Farm map ➤ Soil type map ➤ Soil sampling equipment ➤ Spade ➤ Camera	➤ Farm Management Zones (Chapter 15)
➤ Access previous soil tests		➤ Limits to plant growth (Chapter 2)
1.5 Map FMZs		➤ Plant nutrient requirements (Chapter 3)
1.6 Collect soil samples - FMZs		➤ Soil properties (Chapter 4)
1.7 Assess soil condition - FMZs		➤ Soil biology (Chapter 5)
1.8 Assess pasture condition -FMZs		➤ Soil types (Chapter 6)
		➤ Managing limiting soil factors (Chapter 7)
		➤ Assessing soil nutrients (Chapter 8) ➤ Keeping nutrients on farm (Chapter 10) ➤ Assessing perennial ryegrass condition
Steps - Financial Resources	Tools	Knowhow
1.9 Determine fertiliser financial budget	➤ Farm data collection sheet	➤ Economics of N fertilisers
➤ Access fertiliser records		
Steps - Human Resources	Tools	Knowhow
1.10 Consider contractors, labour & skills.	➤ Farm data collection sheet	➤ Fertcare Accu-Spread
Steps - Animal Health	Tools	Knowhow
1.11 Consider animal health issues	➤ Farm data collection sheet	➤ Nitrate poisoning (Chapter 12) ➤ Grass Tetany ➤ Transition management



1. Situation Analysis (cont'd)

Steps - Infrastructure, equipment & management	Tools	Knowhow
1.12 Consider infrastructure, equipment and management <ul style="list-style-type: none"> ➤ Review fertiliser/effluent handling and distribution. ➤ Consider options for cost effective upgrades. ➤ Consider management practices that can improve fertiliser use efficiency (incl. soil, fertiliser, irrigation, effluent, pasture utilisation). 	<ul style="list-style-type: none"> ➤ Farm data collection sheet ➤ Pasture Consumption and Feed Conversion Efficiency Calculator 	<ul style="list-style-type: none"> ➤ Soil management ➤ Fertiliser management ➤ Effluent management ➤ Irrigation management ➤ Feed conversion efficiency

2. Identify potential and limitations

Steps	Tools	Knowhow
2.1 Determine if goals are realistic 2.2 Identify gaps in knowledge, skills and practices 2.3 Shortlist the options	<ul style="list-style-type: none"> ➤ DairySAT 	<ul style="list-style-type: none"> ➤ Latest research

3. Identify soil and nutrient related issues

Steps	Tools	Knowhow
3.1 Identify soil issues 3.2 Identify irrigation water quality issues 3.3 Limiting crop/pasture condition issues 3.4 Identify farm-scale nutrient issues/options	<ul style="list-style-type: none"> ➤ DairySAT ➤ FMZ Field Sheet 	<ul style="list-style-type: none"> ➤ Soil properties (Chapter 4) ➤ Soil types (Chapter 6) ➤ Managing limiting soil factors (Chapter 7) ➤ Irrigation water quality ➤ Keeping nutrients on farm (Chapter 10) ➤ Nutrient budgets, nutrient maps (Chapter 15) ➤ Using dairy effluent (Chapter 13) ➤ Effluent Calculators (Chapter 13)



4. Interpret data and prepare draft nutrient plan

Steps	Tools	Knowhow
4.1 Identify paddocks and FMZs on a farm map. For each FMZ consider the following: 4.2 Address soil constraints with cost effective management options. 4.3 Compare soil tests/trends with optimum ranges. 4.4 Address soil health: Determine management options. 4.5 Address weeds, pests and disease issues. 4.6 Effluent/manure use: Determine cost effective management options. 4.7 Prepare 4Rs fertiliser program. 4.8 Determine risk management strategies (human, stock, environment). 4.9 Document the nutrient management plan	<ul style="list-style-type: none"> ➤ DairySAT ➤ Fert\$mart Plan example 1 ➤ Fert\$mart Plan example 2 ➤ Fert\$mart Plan template 	<ul style="list-style-type: none"> ➤ Soil types (Chapter 6) ➤ Soil properties (Chapter 4) ➤ Managing limiting soil factors (Chapter 7) ➤ Interpreting soil and tissue tests (Chapter 9) ➤ Keeping nutrients on farm (Chapter 10) ➤ Soil fertility guidelines ➤ Introducing fertilisers (Chapter 11) ➤ Nitrogen and nitrogen fertilisers (Chapter 12) ➤ Using dairy effluent (Chapter 13) ➤ Calculating rates and costs (Chapter 14) ➤ Nutrient planning (Chapter 15) ➤ Developing a fertiliser plan (Chapter 16)

5. Finalise nutrient plan

Steps	Tools	Knowhow
Farmer/advisor discuss & check management options and finalise the draft nutrient plan: 5.1 Soil test results, soil fertility trends and maintenance requirements. 5.2 Check management options are best suited to the farm & farm budget. 5.3 Consider nutrient program costs/economics, e.g. staged nutrient build-up plan. 5.4 Check the 4Rs fertiliser plan suits farm infrastructure, machinery and management 5.5 Discuss implementation of the plan, record keeping and monitoring crop/pasture performance. 5.6 Finalise the nutrient management plan.	The draft nutrient management plan	



6. Implement the nutrient plan

Steps	Tools	Knowhow
6.1 Farmer implements the 4Rs plan (where practical).	<ul style="list-style-type: none"> ➤ Paddock record keeping tool DairySAT checklists: ➤ Soil management ➤ Fertiliser management ➤ Effluent management ➤ Irrigation management 	<ul style="list-style-type: none"> ➤ Fertcare Accu-Spread
6.2 Farmer records the actual sources, rates, placement and timing (including frequency).		
6.3 Farmer follows practices recommended in DairySAT (soils, fertiliser, effluent and irrigation).		

7. Finalise nutrient plan with farmer

Steps	Tools	Knowhow
<p>7.1 Fine-tuning (2-6 months):</p> <ul style="list-style-type: none"> ➤ Farmer monitors pastures, crops and livestock performance and discusses issues with advisor. ➤ Advisor visit and further soil/tissue testing as required to resolve issues. <p>7.2 Annual review (Year 2):</p> <ul style="list-style-type: none"> ➤ Discuss/consider the fertiliser program ➤ Review production targets ➤ Soil/tissue testing if issues exist. ➤ Redo the nutrient budget. ➤ Work out fertiliser maintenance requirements. ➤ Introduce capital fertiliser applications if finances permit. ➤ Update the 4Rs fertiliser recommendations. <p>7.3 Future reviews (Year 3):</p> <ul style="list-style-type: none"> ➤ Soil test every FMZ ➤ Repeat steps in Situation Analysis. ➤ Check soil fertility trends and update the fertiliser program. 		



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