

Sustainable Nutrient Management in New Zealand Agriculture



FARMED
LANDSCAPES
RESEARCH
CENTRE

FLRC - SOIL, WATER, AIR MATTERS



Farmed Landscapes Research Centre,
Soil & Earth Sciences,
School of Agriculture and Environment
Massey University,
Private Bag 11-222 Palmerston North 4442.
New Zealand
Phone: 06 356 9099 extension 84860
E-mail: L.D.Currie@massey.ac.nz
<http://frc.massey.ac.nz>

Fertiliser Association of New Zealand,
Level 2, 58 Victoria Street,
Wellington 6011
PO Box 11519 , Manners Street Central ,
Wellington 6142
Phone: (04) 473 6552
Fax: (04) 473 6551
Email: info@fertiliser.org.nz
<http://www.fertiliser.org.nz/default.aspx>

©Notice of Copyright

Revised in January 2020

The material contained in this folder has been assembled for the purpose of conducting shortcourses for advisors responsible for sustainable nutrient management. All rights reserved. No part of this document may be reproduced or transmitted in any form without the prior written permission of the Farmed Landscapes Research Centre (FLRC), Massey University and the Fertiliser Association of New Zealand.

Table of Contents

1. Farming and Water Quality-Defining the Issue.....	1-1
2. Soil Patterns, Landuse and Climate	2-1
3. Nutrients and Nutrient Cycles	3-1
3.1 Background.....	3-1
3.2 Phosphorus in Soils.....	3-2
3.3 Potassium in Soils	3-24
3.4 Nitrogen in Soils.....	3-36
3.5 Sulphur in Soils.....	3-54
3.6 Other Factors Affecting Nutrient Availability and Loss.....	3-68
3.7 Fertiliser and Manure Reference Resource	3-79
4. Diagnostics.....	4-1
4.1 Understanding Soil Tests	4-1
4.2 Understanding Plant Tests	4-33
5. Nutrient Transfer to the Aquatic Environment.....	5-1
5.1 Water Movement through Agricultural Landscapes	5-1
5.2 Nutrient Transfer to the Aquatic Environment.....	5-12
5.3 Best Management Practices for Protecting the Aquatic Environment.....	5-44
6. Issues with Contaminants in Fertilisers and By-Products.....	6-1
7. Nutrient cycles and Nutrient Budgeting.....	7-1
7.1 Nutrient Cycles and Nutrient Budgeting on Dairy Farms	7-1
7.2 Understanding Overseer® as a Nutrient Budgeting Model	7-13
Reading 1: Overseer® – A nutrient budgeting model for pastoral farming, wheat, potatoes, apples and kiwifruit	7-16
Reading 2: Use of Overseer® to compare farm systems and countries for nutrient balances, losses and efficiency.....	7-26
Reading 3: Use of Overseer® as a tool to identify management strategies for reducing nitrate leaching from farms around Lake Taupo	7-36
Reading 4: Overseer® Nutrient Budget Model – What it is, What it does	7-44
Reading 5: Overseer® Accuracy, Precision, Error and Uncertainty	7-50
Reading 6: Irrigation in Overseer®.....	7-57
8. Overseer	8-1
8.1 Dairying (Waikato	8-3
9. Complying with the Code of Practice for Nutrient Management and Market Requirements.....	9-1
9.1 Using the Code in the Field	9-1
9.2 Global Standards for Sustainable Agriculture	9-10
9.3 Quality Assurance Programmes for Fertiliser and Fertiliser Spreading	9-12

Introduction

Background

In accordance with the Resource Management Act (RMA, 1991), the Code of Practice for Nutrient Management aims to ensure that where fertilisers are applied, they are used safely, responsibly, and in a way that avoids, remedies or mitigates any adverse environmental effects, while ensuring that profitability from fertiliser use is maintained. The RMA provides very general statements on how to measure and assess sustainable land management. Therefore, in order to provide clearer guidance, the Code of Practice for Nutrient Management makes use of an internationally recognised, agriculturally based process known as the Framework for Evaluating Sustainable Land Management (FESLM)^a to assess environmental, social, and economic effects. The FESLM uses five guiding objectives to measure sustainability, which are to:

1. protect natural resources and prevent degradation of soil, water and air quality
2. maintain or enhance production/services
3. be socially acceptable
4. reduce the level of potential risk
5. be economically viable.

The five FESLM principles can be grouped into two areas:

- environmental issues, and
- financial and social issues

The Code of Practice for Nutrient Management focuses on several significant environmental considerations:

- determining the land's requirement for nutrients
- nitrate leaching
- surface water contamination from fertiliser runoff
- surface water contamination from direct application of fertiliser to water
- potential effects of third parties.

The Code of Practice for Nutrient Management also provides practical advice to farmers and growers to assist them in adopting best practices for nutrient management.

^a see FESLM website: <http://www.fao.org/docrep/T1079E/t1079e00.htm>

Course Content and Objectives

This shortcourse has been designed to provide a working knowledge of the assessment of the nutrient requirements of a range of agricultural systems, with consideration to best practice for environmental protection. This course comprises the following sections:

1. Farming and Water Quality-Defining the Issue
2. Soil Patterns, Landuse and Climate
3. Nutrients and Nutrient Cycles
4. Diagnostics: Soil and Plant Testing
5. Nutrient Transfer to the Aquatic Environment
6. Issues with contaminants in Fertilisers and By-products
7. Nutrient Cycles and Nutrient Budgeting
8. Overseer® Nutrient Budgets
9. Complying with the Code of Practice for Nutrient Management and Market Requirements

Sections 1 to 7 of this Study Guide have been provided for pre-course revision on the fundamental principles of nutrient behaviour in soil/plant/animal systems. At the shortcourse, case studies are used to familiarise participants with:

- the theory and current practice of determining nutrient and fertiliser recommendations (with extensive use of the Overseer® nutrient budgeting model),
- estimating nutrient losses from agriculture and their impacts on the wider environment,
- the influences of fertilisers on soil nutrient levels,
- recording the sustainable use of nutrients through the Fertiliser Association of New Zealand's Code of Practice for Nutrient Management,
- indicators used to assess the nutrient status in soil, plants, water and atmosphere,

On completion of this shortcourse participants should:

- a) be familiar with the impact of agriculture on water quality in New Zealand and the associated legal and social issues,
- b) know the theoretical basis on which the current Code of Practice for Nutrient Management is based,
- c) be able to use the knowledge on soil processes and nutrient management taught in the course to critically assess methods proposed for sustainable nutrient management in agricultural systems.

Please Note:

The delivery of this course in 2020 has been affected by the Covid-19 pandemic.

Whilst the Course Content and Objectives remain the same, there is no contact course involved and the material that would have been presented at the contact course is now made available on-line. Details about the delivery processes will be sent to you in a series of emails.