Australian Soil Club
Winter 2005

Welcome to the first edition of the Australian Soil Club newsletter for 2005/2006.

Firstly, thank-you to all those who renewed their subscriptions and continue to support our soil science work. Your subscription will remain current to 30 June 2006.

We have made some changes over the past year and are pleased to announce that we have a new partner to take us forward. The Regional Institute Ltd is a not-for-profit group working with scientists, extension officers and organisations to make research accessible to farmers and other land managers. It is already one of Australia's largest providers of online information to the agricultural community via its website www.regional.org.au.

The Regional Institute will be partnering with ASC to build our online resources for subscribers at www.soil.org.au. We look forward to sharing research information as well as practical knowledge about soil biology with farmers across Australia.

Contact:
Professor Lyn Abbott
Head, School of Earth and Geographical Sciences
The University of Western Australia

Email:
labbott@cyllene.uwa.edu.au

Export of Phosphorus to Waterways from Irrigated or Rain-fed Pastures

It is widely acknowledged that the application of phosphorus-based fertilizers to crops and pastures contributes to the export of phosphorus from fertilized fields to waterways. The resulting raised levels of phosphorus in waterways can have detrimental effects, including algal blooms that can compromise water resources and wetland ecology.

Given the serious impacts of phosphorus in our waterways, it is important to understand when, where and what phosphate fertilizer applications most seriously affect the export of phosphorus to waterways. Studies have shown that different fertilizers contribute various quantities of phosphorus to waterways. Similarly, increasing time between fertilizer application and irrigation or rainfall can decrease the amount of phosphorus exported.

A recent study, published in the Australian Journal of Soil Research by Nash et al (2004) examined phosphorus export from pasturelands in South Eastern Australia. The most commonly used phosphate fertilizers in these regions are DAP (diammonium phosphate), a form of fertilizer in which phosphorus dissolves more quickly, and SSP (single superphosphate), which has a slower dissolution rate.

In their recent study, Nash et al (2004) investigated the relationship between phosphorus exports from SSP and DAP due to overland flow from border irrigation as opposed to natural rainfall. DAP and SSP were applied independently to both irrigated and rain-fed pastures and phosphorus exports were measured for both types of fertilizer. Interesting, the authors found that rainfall and irrigation affected the export of phosphorus differently for the two commonly used fertilizers. While DAP contributed more dissolved phosphorus than SSP in the rain-fed scenario, under irrigation, SSP exported more phosphorus than DAP.

Why should border irrigation and natural rainfall have different affects on two commonly used fertilizers? Nash et al (2004) propose that the differing dissolution rates of the two fertilizers, in combination with the moisture content and infiltration characteristics of the soil prior to the flow event, contribute to these disparate results.

For the rainfall scenario, soil was already moist from

continued page 2

from page 1

previous irrigation. As such, there was limited infiltration of water into the soil and limited opportunity for soil to remove phosphorus. Nash et al (2004) suggest that the more soluble DAP quickly dissolved to export more phosphorus than SSP.

By way of contrast, in South Eastern Australia, pastures are only irrigated when there is a soil moisture deficit of at least 40mm. Thus, in the irrigation scenario, the quickly available phosphorus from DAP immediately infiltrated the soil, instead of contributing to run-off. By the time phosphorus from SSP became available, however, soil moisture content had risen and infiltration rates had dropped significantly.

Phosphorus from SSP, therefore, was less likely to infiltrate the soil, and more likely to contribute to export through overland flow.

The findings of this experiment clearly demonstrate that phosphorus export is dependent on a multitude of site-specific variables. While Nash et al (2004) warn that it is premature to extrapolate legislative instruments on the basis of the site-specific results from a field study, there are several matters of consideration for land managers

wanting to reduce the impacts of fertilizer on waterways. In particular, the authors maintain that, in rain-fed pastures, up to 25% reduction in phosphorus exports could be achieved by applying fertilizer during dry seasons, avoiding the application of the rapidly dissolving DAP to soil with a high moisture content, and thus avoiding exports of phosphorus by overland flow.

For irrigated areas, Nash et al (2004) suggest that the exclusive use of DAP could significantly reduce the export of phosphorus by overland flow. In addition, the authors suggest that 30-50% reduction in phosphorus exports could be achieved by maximising time between fertilizer application and irrigation.

While the results of studies like the one considered here can provide guidance for land managers, these studies also emphasise the complex interactions between phosphorus-based fertilizers, soil and water systems. It is important to consider the many site-specific variables that might influence phosphorus exports.

It is clear that further research is necessary to help land managers optimise their production, while simultaneously maintaining the health of waterways in agricultural regions.

Adapted from D. Nash et al. (2004) 'A field study of phosphorus mobilisation from commercial fertilisers', Australian Journal of Soil Research: 42, 313-320.

How Does Eutrophication Occur?

Eutrophication is a process that occurs when nutrients gradually enrich waterways. Although eutrophication is naturally occurring, the use of phosphate fertilizer can accelerate the process through export of phosphorus from farms to waterways.

When nutrient levels in waterways increase, the growth of aquatic plants, including phytoplankton, also increases. Dramatic growth in phytoplankton levels is called an algal bloom. Algal blooms can have serious implications: increased algae levels can increase sediment formation to the extent that water channels may be blocked and can decrease oxygen levels to the extent that fish may not survive.

All of these consequences of eutrophication can lead to secondary affects, influencing the entire wetland ecosystem, and compromising our water resources.

R. White (1979) Introduction to the Principles and Practice of Soil Science (Blackwell Scientific Publications: Oxford, London, Edinburgh, Melbourne).

Keep in-touch and Stay in-formed

The Australian Soil Club has established a website (www.soil.org.au).

Developed by new ASC partner, The Regional Institute Ltd, the website is a powerful and interactive tool to share our collective knowledge and experience of soil science. It is also intended as a 'storage silo' for research and conference papers, reports, journal articles, workshops and practical information. Issues to be covered include soil types, stubble and nutrient management, soil compaction, deficiencies and moisture availability, liming, organic fertilisers, acidity, salinity, soil electrical conductivity and increasing organic matter.

The website will help the ASC to improve the management of its subscribers database and increase communication opportunities. It will enable researchers, farmers, extension officers, departmental staff and other people involved in land management to form an active 'online soils community.'

The section called 'My Dirt' features the Kojonup Soils Centre, a regional soils group based in South West WA, at www.soil.org.au/wa/kojonup. We are seeking to grow this section of the website to include regional soils groups from around Australia, who can all have their own space within the ASC community.

You will notice a link on the website to www.soilhealth.com. This is Prof. Lyn Abbott's new website and contains valuable information about soil biological processes. The website will be used to launch her much anticipated book, "Soils are Alive", at the beginning of 2006.

Invitation to register

As subscribers to ASC we invite you to register on the website (see below) to enable us to communicate with you about conferences, workshops or new research information. Registration will also allow you to feedback to us the issues or topics that you would like information about and to contribute articles for publication.

How to register?

1. Go to www.soil.org.au
2. Click on the register link.
3. Fill in the form (the boxes with a red asterisk are compulsory) and press "Submit".
4. You will receive a confirmation email to automatically log you in to the website.
5. Once you are logged in, please go to the top of the page and click the My Tools drop-down link. This is where you will be able to access functions such as Address Book, Forums and My Documents, where we invite you to upload articles or documents to your private Intranet.

For more information please email soil@soil.org.au

How Do Phosphate Fertilizers Work?

Both the ammonium phosphates, as well as the superphosphates, are known as orthophosphates, a highly soluble form of phosphate fertilizer. These fertilizers are usually available in granular form which, when added to soil, take up water through vapour diffusion, or through osmosis, to form a salt solution. This solution enters the soil and reacts with minerals to form soil-fertilizer reaction products. Plants feed primarily on these highly soluble compounds, which, over time, slowly revert to more stable and less soluble products. Depending on the fertilizer type and soil type, a wide variety of soil-fertilizer reaction products may be formed, providing plants with a large scope of available of phosphorus.

Soil Infiltration

Water from rainfall or irrigation is said to infiltrate the soil, while water run-off, on the other-hand, is called overland flow. Water will continue to infiltrate the soil at a steady rate of flow after the soil is saturated, percolating to the water table and boosting ground water levels.

Interflow, or subsurface flow, occurs on slopes, or when access to the watertable is obstructed. While overland flow contributes significantly to waterways, subsurface water can also contribute to waterways through interflow. As the infiltration of soil increases, overland flow and interflow can also increase, creating circumstances in which export of phosphorus from phosphate fertilizers can occur.

How Are Phosphate Fertilizers Manufactured?

The active ingredient in all superphosphates, including SSP, is monocalcium phosphate, which is manufactured by dissolving naturally occurring rock phosphates in sulphuric acid. The active constituent of DAP (one of the ammonium phosphates), on the other hand, is phosphoric acid, which is manufactured either by treating rock sulphate in sulphuric acid or by heating rock sulphate in a furnace and dissolving the resulting compound in water.

R. White (1979) Introduction to the Principles and Practice of Soil Science (Blackwell Scientific Publications: Oxford, London, Edinburgh, Melbour

New Land Use Research Initiative in New Zealand

Land use research in New Zealand is undergoing an exciting renewal with the establishment of the Sustainable Land Use Research Initiative (SLURI). This is a national centre for maintaining and managing soils in New Zealand based on research focused on the sustainable land management. It is also intended to develop new tools for regulators and land managers. Key stakeholders and other research organisations will be involved in developing the research program.

SLURI believe there is a need for research on sustainable land use because

* Soil quality and management supports productive industries in New Zealand with 17% of New Zealand's GDP depending on the top 15 cm of its soil.

* Soil is at the heart of New Zealand's clean green image.

* Failure to sustain soil and water resources will put $2.16 billion of New Zealand's total GDP at risk.

* New Zealand needs to assess and predict the effects of changes in land use on soil quality.

* Five themes (or priorities) have been identified for preserving and managing NZ soils:

* Soil functioning
Soil is the fertile skin of the earth. It stores water, nutrients and agri-chemicals, provides a habitat for a huge range of organisms, and is our primary water filter.

* Managing land use
Only 54% of New Zealand's land can sustain agriculture and just 5% can support horticulture. We must use it wisely.

* Resilience under change
A resilient soil functions well, even when put under pressure by changes in use or climate.

* Valuing natural capital
In the 21st century, the value of soil must reflect all its environmental benefits if markets and institutions are to ensure its efficient and sustainable use.

* Strategic land use management
New Zealand's mosaic of managed and natural ecosystems must coexist sustainably.

The information for this article was taken from the SLURI website at www.sluri.org.nz

ASC *Mission statement*

To provide information about soil that is relevant to all land users.