

# **International Experience, Nutrient Best Management Practices and Product Stewardship**

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## **Summary**

The public expect to have access to affordable, healthy food while at the same time having their expressed concerns about the impact of agricultural systems on the environment addressed.

As plant nutrients are one of the most important inputs to agricultural systems, the fertiliser industry has assumed responsibility for developing guidelines on nutrient management that will minimise environmental impacts and maximise economic benefit.

This is being achieved internationally through an initiative of the International Fertiliser Industry Association (IFA), which has facilitated the development and promotion of best management practices for fertiliser.

These international developments are discussed and related to product stewardship and best management practices initiatives in Australia and New Zealand.

## **Introduction**

Agriculture is in a unique position. It is expected to provide for an increasing population while at the same time reducing its impact on the environment.

The expectation of the public is for sufficient, affordable and healthy food. In addition, there are demands that food production not only keeps pace with the growing world population, but also halve the number of undernourished in developing countries by 2015 at the latest (FAO, 2003a).

The implication of this is that there will be a need for increasing agriculture production and intensification.

It is recognised that agriculture, while providing for human food requirements, places a serious burden on the environment (FAO, 2003b). Nutrients, mainly in the form of applied fertiliser, are the main source of nitrate pollution to groundwater and surface water, are a source of ammonia and nitrous oxide as well as contributing phosphate to waterways. In addition to these direct effects on the environment, there are indirect effects related to manufacture, storage, transport and application of fertiliser.

Despite the importance of agriculture in providing food to a growing population there are increasing public concerns regarding the impacts of agriculture on the environment. These concerns have already resulted in restrictive regulations on fertiliser use which may not necessarily be in the best interests of consumers or producers.

In anticipation of these developments the agriculture sector in some countries, including Australia and New Zealand, have developed guidelines aimed at the efficient and effective use of nutrients. In many other countries, due to limited scientific resources, level of intensification or limits on the availability of a consistent supply of fertiliser, developing guidelines for sustainable fertiliser use has not been a

priority. Recognising this the international fertiliser industry initiated the development of guidelines for use in formulating best nutrient management practices.

### **National Initiatives**

In a number of countries guidelines usually in the form of fertiliser best management practices have been developed. Examples include:

Australia	Cracking the Nutrient Code – A guide for developing your nutrient code of practice.
New Zealand	The code of practice for nutrient management - with emphasis on fertiliser use.
France	Code of Reference for Integrated Farming (Eveillard, 2007)
United Kingdom	Whole farm nutrient plan (Krauss, 2007)
United States	Fertiliser best management practices (Krauss, 2007)
Europe	Integrated farming framework (EISA, 2006)

Similar documents are under preparation or consideration in Brazil, China, India and Russia.

Documents are often developed in conjunction with other stakeholders including farmer organisations, regulatory authorities, environmental and community groups as well as gatekeepers (eg. Supermarkets). They are designed to be applied on a local or regional basis and are able to address site specific issues.

In general fertiliser best management practice guidelines have been developed in countries with intensive highly productive farming systems (Table 1). In subsistence or transitional agricultural systems the emphasis is focused more on acquiring and applying meaningful amounts of nutrients. In countries with these systems there is often a limited or restricted skills base and research capability.

**Table 1: Assessment of existing national status of fertiliser best management practice guidelines (IFA, 2007)**

Status of crop production	Subsistence farming	Transition, mixed with estate/plantation farming	High tech farming based mostly on voluntary practices	High tech farming with substantial government mandate
Countries under consideration	<ul style="list-style-type: none"> <li>▪ Sub-Saharan Africa (except South Africa)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Argentina, Brazil, China, India, Indonesia, Saudi Arabia, Russia</li> </ul>	<ul style="list-style-type: none"> <li>▪ USA, Canada (+large-scale farming in Brazil and Argentina)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Australia, New Zealand, EU</li> </ul>
FBMPs	<ul style="list-style-type: none"> <li>▪ Not issued</li> </ul>	<ul style="list-style-type: none"> <li>▪ Not issued e.g. Argentina, Saudi Arabia, Indonesia</li> <li>▪ Under preparation eg. China, Brazil, India, Russia but still not a thrust area for the concerned agencies or the industry</li> </ul>	<ul style="list-style-type: none"> <li>▪ Crop and site-specific FBMPs eg. In the USA</li> <li>▪ Integrated approach as with animal husbandry and environmental considerations</li> </ul>	<ul style="list-style-type: none"> <li>▪ Integrated approaches with focus on competitiveness in global markets eg. In Australia and New Zealand</li> <li>▪ Integrated approaches with focus on food quality and safety and on environmental issues eg. In the EU</li> </ul>
Partners in developing FBMPs	<ul style="list-style-type: none"> <li>▪ Not yet applicable. Potential partners include IFDC, research and extension, farmers' organisations, stockists and dealers</li> </ul>	<p>Variable partners eg.</p> <ul style="list-style-type: none"> <li>▪ Argentina, Brazil, private sector (Fertiliser, IPNI ANDA) + extension and research (INTA Embrapa)</li> <li>▪ Saudi Arabia: private sector (SABIC) + government</li> <li>▪ Indonesia: private sector (LPI) + farmers' organisations</li> <li>▪ China, Russia: private sector (IPNI, IPU, fertiliser companies) + research</li> </ul>	<p>Multifaceted approach eg. In the USA consisting of</p> <ul style="list-style-type: none"> <li>▪ Private sector (IPNI, FAR...)</li> <li>▪ + research</li> <li>▪ + government</li> <li>▪ + farmers' organisations</li> <li>▪ + extension</li> <li>▪ + local agribusiness</li> </ul>	<p>Variable partners partially with integration of environmental issues eg.</p> <ul style="list-style-type: none"> <li>▪ Australia: private sector (FIFA)</li> <li>▪ New Zealand: private (FertResearch) + farmers organisations</li> <li>▪ France, Germany: associations in integrated farming (eg. FARRE)</li> <li>▪ UK: private (A?C&lt; PDA) + government (DEFRA) + ENVIRONMENT AGENCIES (FACTS) +</li> </ul>

		<ul style="list-style-type: none"> <li>India: Ministry of agriculture + research (ICAR) + private sector (IPNI, IPI, fertiliser industry), extension services, agencies</li> </ul>		integrated farming organisations (LEAF)
Promotion of FBMPs	<ul style="list-style-type: none"> <li>Not yet applicable</li> </ul>	<ul style="list-style-type: none"> <li>Seminars, publications, field days, demonstration organised by private sector (eg. IPNI, IPI, fertiliser industry), extension services, agencies, etc.</li> </ul>	<ul style="list-style-type: none"> <li>Seminars, publications, internet, field days, demonstration organised by private sector (eg. IPNI, IPI, fertiliser industry), extension services, agencies, etc.</li> </ul>	<ul style="list-style-type: none"> <li>Seminars, publications, internet, field days, demonstration organised by private sector (eg. Fertiliser industry), extension service, agencies etc.</li> </ul>
Adoption of FBMPs	<ul style="list-style-type: none"> <li>Not yet applicable</li> </ul>	<ul style="list-style-type: none"> <li>Improves with farm size and education level</li> <li>Related to physical distance from research/promotion entity</li> <li>Requires constant follow-up</li> </ul>	<ul style="list-style-type: none"> <li>Provided the FBMPs are economically feasible and logistically compatible with the farm system and the enterprises that sometimes compete for labour, management and resources, FBMPs will usually be accepted</li> <li>Awareness that FBMPs could be a management tool for increased fertiliser use efficiency, improved farm income and reduced risks would also accelerate adoption</li> </ul>	<p>Adoption encouraged because:</p> <ul style="list-style-type: none"> <li>FBMPs are integrated into quality assurance programmes, land use policies and meets regulatory requirements</li> <li>FBMPs support traceability of nutrients and transparency of actions</li> <li>FBMPs should support compatibility on the global market</li> </ul>

### **International initiative**

The role of best management practices as a viable option to the inflexibility and cost of formal regulations was recognised by the International Fertiliser Industry Association (IFA). Following discussions with member organisations, IFA launched an initiative to develop and issue a global framework of fertiliser best management practices (FBMPs) as a model to develop local FBMPs.

The objectives of the framework are (IFA, 2007):

- Based on sound science, to manage plant nutrients and crops and to produce enough nutritious and safe food in an environmental-friendly, economically viable and socially acceptable manner;
- By actively integrating and engaging stakeholders into the development and implementation of FBMPs, to achieve highest possible transparency of the flow and traceability of the fate and behaviour of applied nutrients with a minimum of legislative and regulatory interventions;
- Through dialogue with all relevant stakeholders on the benefits and possible risks associated with the use of inorganic fertiliser, to create an atmosphere of trust between producers and users of plant nutrients on one hand and with the consumers of the resulting food products on the other hand;
- To assist in the continued development and promotion of FBMPs adapted to the specific needs of developed and developing countries;
- To create a dynamic body of knowledge, which has to be specific enough but not prescriptive.

IFA has established a Task Force on FBMPs which is working on the development and adoption of FBMPs. This will include an assessment of existing material, content of existing FBMPs, their development, uptake and adoption.

A workshop was held earlier this year which facilitated the exchange of general principles of FBMPs, developing a strategy for their uptake and exchanging information on national experiences.

The main issues being considered are:

- To create understanding and awareness about the fate of nutrients, the risks linked to nutrients use, the potential for environmental pollution, and the misuse of natural resources.
- To consider risks associated with operational activities (storage, trading, transport and application)
- To consider the risks associated with agronomic activities (rate, timing, form and placement)
- To consider environmental targets (groundwater, surface water, soils, neighbouring population, biodiversity, odour and emissions).

During workshop discussions a simple principle (the four Rs) was presented (Roberts, 2007) and received wide support:

- **Right product** – match nutrients to crop needs
- **Right time** – make nutrients available when crops need them
- **Right phase** – place and keep nutrients where crops can use them
- **Right rate** – match amounts of nutrients to crop needs.

This principle although appearing simple consists of elements that are relevant to farmers, consumers and regulating authorities.

**Table 2 Elements of the four Rs approach**

<b><i>Right Product</i></b>	<ul style="list-style-type: none"> <li>▪ Soil testing</li> <li>▪ N, P, K, secondary and micronutrients</li> <li>▪ Enhanced efficiency of fertilisers</li> <li>▪ Nutrient management plans</li> </ul>
<b><i>Right Times</i></b>	<ul style="list-style-type: none"> <li>▪ Timing of application</li> <li>▪ Controlled release technologies</li> <li>▪ Inhibitors</li> <li>▪ Fertiliser product choice</li> </ul>
<b><i>Right Place</i></b>	<ul style="list-style-type: none"> <li>▪ Application method</li> <li>▪ Incorporation of fertiliser</li> <li>▪ Buffer strips</li> <li>▪ Conservation tillage</li> <li>▪ Cover crops</li> </ul>
<b><i>Right Rate</i></b>	<ul style="list-style-type: none"> <li>▪ Soil testing</li> <li>▪ Yield grab analysis</li> <li>▪ Crop removal balance</li> <li>▪ Nutrient management planning</li> <li>▪ Plant tissue analysis</li> <li>▪ Applicator calibration</li> <li>▪ Crop scouting</li> <li>▪ Record keeping</li> <li>▪ Variable rate technology</li> <li>▪ Site-specific management</li> </ul>

The material from the workshop is in the process of being refined but can be seen to have the potential of a comprehensive guideline for developing site-specific, effective FBMPs.

It is proposed that the material from the workshop will be published and distributed at the 4<sup>th</sup> International Nitrogen Conference in Brazil during October 2007.

#### **Initiatives by the Australian and New Zealand Fertiliser Industries**

Both Australian and New Zealand have recognised the importance of FBMPs in providing for a more cost effective and flexible means of managing nutrients, than can be achieved through a strictly regulatory approach.

Although both countries have developed FBMP tools – there are differences which reflect national and local conditions. Despite this the approaches taken are in line with the objectives and principles identified by the IFA initiative.

#### ***Australia***

An assessment of losses of nutrients from farming (Australian Agriculture Assessment, 2001) identified the need for attention to be paid to nutrient status, monitoring as well as tracking changes in all farming systems. In response to this the Fertiliser Industry Federation of Australia (FIFA) developed and published “Cracking

the Nutrient Code – A Guide to Developing Your Nutrient Code of Practice (2001)”. This document is a set of guidelines to help individual farmers, industries and regions develop their own specific Nutrient Management Code of Practice. The guidelines promote the development and use of best management practices which address production outcomes and environmental impacts.

The BMPs are based on three guiding principles:

- Awareness and understanding of risk
- Employing available nutrient management tools
- Adopting a system of continuous improvement

FIFA has promoted the incorporation of BMP onto the broader based fertiliser stewardship programme, ‘Fertcare’ (Drew, 2007), which consists of:

- A training, quality assurance and certification programme, focused on food safety and environment issues associated with fertiliser and soil ameliorants.
- Balanced approach to productivity
- National and open
- Developed with reputable independent expertise and Government support
- Training delivered to national competencies under the ANTA framework
- Intent is for all industry personnel to provide best management practice advice.

In addition to promoting an holistic, comprehensive approach to nutrient management, incorporating production and environmental components, the fertiliser industry has set commitments for 2008. These include:

- 100% of eligible staff trained/quality assured
- 100% of contract spreaders certified
- 100% of premises audited

### ***New Zealand***

The New Zealand fertiliser industry, through the industry association Fert Research, has implemented a number of initiatives relating directly and indirectly to FBMPs (Sneath and Furness, 2006).

Code of Practice for Fertiliser Use: The Code of Practice for Fertiliser Use and associated updates and revisions has been one of Fert Research’s most significant investments. The Code was produced in 1998, bringing together accumulated knowledge on fertiliser use and best practice for nutrient management. Being non prescriptive and effects based, it is unique in addressing issues on a site specific basis.

In 2002 a review of the Code was undertaken. The basic approach was unchanged but additional information was introduced on salient and emerging issues (spreading developments, cadmium, nitrate management, greenhouse gas issues).

A further comprehensive review was undertaken in 2006 and completed in March 2007. A significant change in approach is in addressing broader nutrient sources rather than an exclusive focus on fertiliser. To reflect this the Code was renamed the *Code of Practice for Nutrient Management – with emphasis on fertiliser use*. Fertiliser use is considered in the broader context of nutrient management. With this approach a nutrient budget is the basis for developing a nutrient management plan and placing nutrient management within the context of a farm management system.

Compliance with the Code and implementation of best management practices is a requirement of a number of regional authorities for fertiliser use to be a permitted activity, without restrictions and prescriptive limits. The Code has also been incorporated into a number of Quality Assurance Programmes. Some of these programmes enable participants to gain access to higher value international markets. In these instances compliance with the Code is a means of demonstrating the adoption of BMPs may be part of a Quality Assurance Programme Audit.

In addition to developing the Code of Practice for Nutrient Management, the New Zealand fertiliser industry has played an active role in related best management practice initiatives. These include:

- Fertmark Scheme: a fertiliser quality assurance programme developed in conjunction with the national farmers' association (Federated Farmers of New Zealand).
- The Fertmark Code of Practice relates to all fertiliser made and sold under the Fertmark programme. It provides assurance that Fertmark registered products, if used properly, do not pose hazards to food safety or animal welfare.
- Spreadmark Scheme: a quality assurance scheme for the placement of fertiliser on farm land and includes both ground and aerial applications.
- OVERSEER Nutrient Budget Model: OVERSEER is a computer model for estimating annual averages for the nutrients moving on and off a farm. Assuming a set production level, the model provides a mechanism for simulating and comparing different management practices, estimating the utilisation of applied nutrients, efficiency of nutrient use, and identifying potential environmental impacts and evaluating mitigating options.
- Training Course: The Fertiliser and Lime Research Centre at Massey University, in conjunction with the fertiliser industry, have developed courses for the accreditation of advisors responsible for providing safe and effective nutrient management advice.

## **Conclusions**

The initiative, by IFA, to develop FBMPs is timely and demonstrates a proactive and committed approach to address calls for more efficient use of nutrients. However, the work of the IFA Task Force will need to be followed up if the challenges of adoption and uptake of FMMPs are to be met, particularly relating to:

- The knowledge-intensive nature of FBMPs
- Profitability being a key driver of uptake
- Farming is a social, cultural and economic activity

Farmer knowledge, experimental learning and existing social capital will need to be leveraged if widespread adoption is to be achieved. There will also be a need for multiple partners, from all sectors of the fertiliser industry, working together if progress is to be made on a worldwide basis.

As far as Australia and New Zealand are concerned they can regard themselves as world leaders in successfully developing, promoting and implementing FBMPs. There

is, however, no room for complacency as issues associated with climate change and reactive nitrogen in particular along with increasing public expectations relating to food security, safety and environmental impacts will provide many challenges for the fertiliser industry.

## References

Australian Agricultural Assessment (2001). National land and Water Resources Audit Turner, ACT. ISBN 0 642 371210

Cracking the Nutrient Code (2001). Guidelines for developing a nutrient management code of practice for your industry region or farm. Fertiliser Industry Federation of Australia, Canberra, ACT Australia

Drew, N (2007) Fertcare® Putting best practice into stewardship. IFA International Workshop on Fertiliser. Best Management Practices (GAPs). Background paper for the FAO export consultation on Good Agricultural Practices, Rome, 10-12 November 2004

European Integrated Farming Framework (2006). A European definition and characterisation of integrated farming as a guideline for sustainable development of agriculture. European Initiative for Sustainable Development in Agriculture (EISA)

Eveillard, P (2007). Voluntary farm management qualification under the French official "Integrated Farming" scheme IFA International Workshop on Fertiliser Best Management Practices. 7-9 March 2007, Brussels, Belgium.

FAO (2003) (a) Summary analysis of relevant codes, guidelines, and standards related to Good Agriculture Practices (GAPs). Background paper for the FAO expert consultation on Good Agricultural Practices, Rome, 10-12 November 2003

FAO (2003) (b) World Agriculture Towards 2015/30. On FAO perspective Earthscan ISBN 92 5 104835 5

IFA (2007) IFA International Workshop on Fertilizer Best Management Practices (FBMPs). 7 – 9 March 2007. Brussels, Belgium

Krauss, A (2007) Global assessment of the situation of FBMPs IFA International Workshop on Fertiliser Best Management Practices 7-9 March 2007, Brussels, Belgium

Roberts, T.L. (2007) Right product, right rate, right time, and right place... the foundation of best management practices for fertiliser IFA International Workshop on Fertiliser Best Management Practices 7-9 March 2007, Brussels, Belgium

Sneath, G and Furness H (2006) Progress in developing and implementing nutrient management tools and systems for New Zealand agriculture. In: Proceedings of the Workshop "Implementing Sustainable Nutrient Management Strategies in Agriculture," Massey University, Palmerston North, New Zealand, 8-9 February 2006.