Nutrient best management practice: the Australian experience

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Abstract
In the last decade, the challenges of the unique combination of soil, climate, ethnic background and economic drivers has moved Australian agriculture away from the original European practices to those more attuned to local conditions. Nutrient management has also been refined primarily to provide economic efficiency for low or no subsidy export oriented industries. More recently the impact of sub-optimal nutrient management methods on land that is adjacent to high visibility multi-use resources has changed nutrient best management from a productivity driven approach toward a balance between productivity, resource management and environmental protection. The challenge for the future is in maintaining an appropriate balance of food production and environmental conservation in the face of complex production issues and the integration of the changing demands of our modern society.

Key Words
Productivity, environment, economic, risk, social.

Introduction
Australia is a country of great physical diversity with unique combinations of predominantly geologically old soils, unreliable weather patterns and a wide diversity of plant species grown for food and fibre. With the diversified cultural backgrounds of the population, it is probably not unexpected that a somewhat unique approach to agricultural production would develop over time. Nutrient management, as part of agricultural production, has also developed some unique features. Agriculture in the 1900s began to move from a European style (frequent and inten**sive** cultivation) toward what is probably now considered a unique and locally-adapted Australian approach to farming that is more attuned to the variability of the Australian climate and soils (Smith 2009). Some of these features are now being adopted in developing areas of the world with similar soils and climate. Management practices and products that reduce risk, on both input and output sides of production systems, have been adopted rapidly, e.g. the expansion in area of reduced and zero tillage, tram-lining, opportunity cropping and seed placement of starter P in broadacre grains; the green cane trash blankets in sugarcane, and the move to fertigation, drip and trickle irrigation in horticulture. The changes to soil and water management have had flow on effects to the fertiliser products, their application placement, timing and frequency. This is exemplified in the changes to cotton nutrient management that are integrated with improved water and insect management (Roth and Squires 2007, NLWRA 2008).

The development of new farming practices, together with changes in commodity prices and the introduction of new crops (e.g. canola in the mid 1980s) saw the rapid growth of nutrient use especially nitrogen (N) in this country (Figure 1). In Australia, there exists no single formal national framework or set of guidelines for developing nutrient best management practices (BMP). The programme that comes closest to a national nutrient BMP is FERTCARE ®, a joint initiative of Australian Fertiliser Services Association (AFSA), the Fertilizer Industry Federation of Australia, (FIFA), and the federal Departments of Environment and Heritage (DEH) and Department of Agriculture, Fisheries and Forestry (DAFF), launched in 2004. This project was primarily developed to address emerging environmental issues associated with fertiliser use but quickly evolved a framework for nutrient BMP and adviser accreditation (FERTCARE ® Accredited Adviser) for the fertiliser industry, (Drew 2007). It is yet to spread to the independent consultant network, although it has been recognized in recent State-based regulatory frameworks. Other nutrient BMPs that exist have generally been developed in response to industry segment productivity and to a lesser degree environmental issues, and/or as part of an extension add-on to a research project (Table 1). BMPs prior to mid 1990s generally focused on production optimisation, e.g. maximum economic return or production per unit of input only.

More recently research on the quality of water entering the Great Barrier Reef (GBR) and implications back to management of agricultural production (land) on the adjacent mainland, and the algal blooms in the Murray-Darling and Swan Rivers have been influential in changing the focus of nutrient BMP from a purely

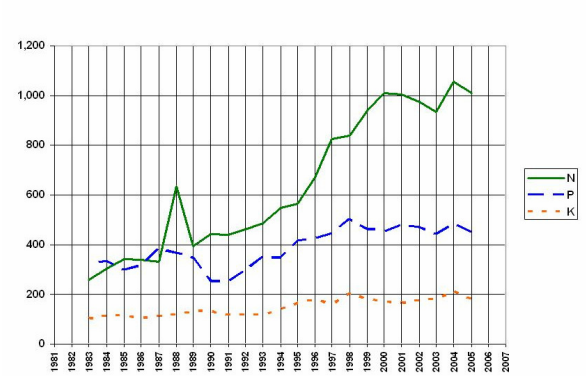

Figure 3. Nutrient consumption (kt of element) for Australia 1981-2007 (Source: Fertilizer Industry Federation of Australia).

production/ economic efficiency basis to having a growing consideration for resource and environmental conservation. More recently we have seen the quality of water entering the GBR and in the Swan coastal plain around Perth (WA), subject to a statutory regulatory approach to nutrient BMP to meet legislated targets in the management of environmentally active nutrients (N and P). In the case of the GBR, the sugar industry nutrient BMP (Six Easy Steps) has been a key component in formation of regulations that are able to accommodate both production and environmental objectives.

National Land and Water Resources Audit (2001) provided hard data to the growing undercurrent of opinion that vast tracts of agricultural land were being "mined" for nutrients, i.e. there was a net negative nutrient balance. This was further reinforced by results from the GRDC Nutrient Management Initiative (NMI) for the subtropical grain producing areas (Bell 2005).

Table 8. Recent major agricultural, pastoral and horticultural industry programmes containing nutrient BMP in Australia.

SEGMENT	PROGRAMME	ORGANISATION	DATE
Grains	GRDC Nutrient Management Initiative	DAFF	2005 - 2008
	Better Fertiliser Decisions – Grain	Grains Research and Development Corporation (GRDC)	2009 – 2012
	Better Soils	Agricultural Bureau of South Australia	1997 - ongoing
Horticulture	Northern Rivers Soil BMP Guide – Perennial Horticulture	NSW DPI, Landcare	2008 – ongoing
	Healthy Soil for Sustainable Farms – Ute Guide	AusVeg	2006 - 2008
Extensive Grazing	Making More from Sheep -	Meat and Livestock Australia (MLA), Australian Wool Innovations (AWI)	2004 – ongoing
	More Beef from Pastures	Meat and Livestock Australia	2004 – ongoing
	Better Fertiliser Decisions – Pasture	Victorian Department of Primary Industries (VDPI)	2003-07
	Better Soils	Agricultural Bureau of South Australia	1997 - ongoing
Intensive Grazing	Target 10 – Dairy	Dairy Australia, Victorian Department of Primary Industries	1998 – ongoing
	Better Fertiliser Decisions - Pasture	Victorian Department of Primary Industries (VDPI)	2003 - 07
Sugarcane	COMPASS	Bureau of Sugar Experiment Stations	2005 - ongoing
	Six Easy Steps		2005 - ongoing
Cotton	Australian Cotton Industry BMP Manual	Cotton Research and Development Corporation	2000 - ongoing
	Nutripak	Cotton Catchment Communities Co-operative Research Centre	2001 - ongoing
All	Healthy Soils for Sustainable Farming	DAFF	2006-2008
	FERTCARE ®	FIFA	2004 - ongoing

Nutrient BMPs need to be multi-dimensional to provide the necessary triggers for individuals to adopt any new practice. They must also provide the "working space" within their guidelines to allow for diversity and individuality that are important cornerstones of innovation, which is so important to the practical implementation of the scientific principles.

In times past, when management practices were generally driven to improve economic performance, extension was single dimensional, i.e. focus on parameters that were directly related to economic returns, i.e. nutrient use efficiency, $ return/ kg input, net economic return/ha.

To be universally acceptable, new uniform nutrient BMPs must recognize that for most primary producers the dollar is now rarely the prime motivator for the adoption of new practices; rather it is a mix of financial security and risk, lifestyle tradeoffs, and how the change aligns with firmly held beliefs. Additionally this mix may vary according to the change in practice required (Figure 2).It is the influence of this curious mix of lifestyle, beliefs and risk preferences that has seen growth in practices and philosophies that challenge the balance between financial reward and protection or building soil properties and processes. In recent years the growth in organic agriculture, significant increase in consumption of "alternate" fertilizer products and the migration of mainstream farming toward more soil friendly practices, such as lower soil disturbance, retention crop residues and recycling of nutrient rich waste products are prime examples of this change.

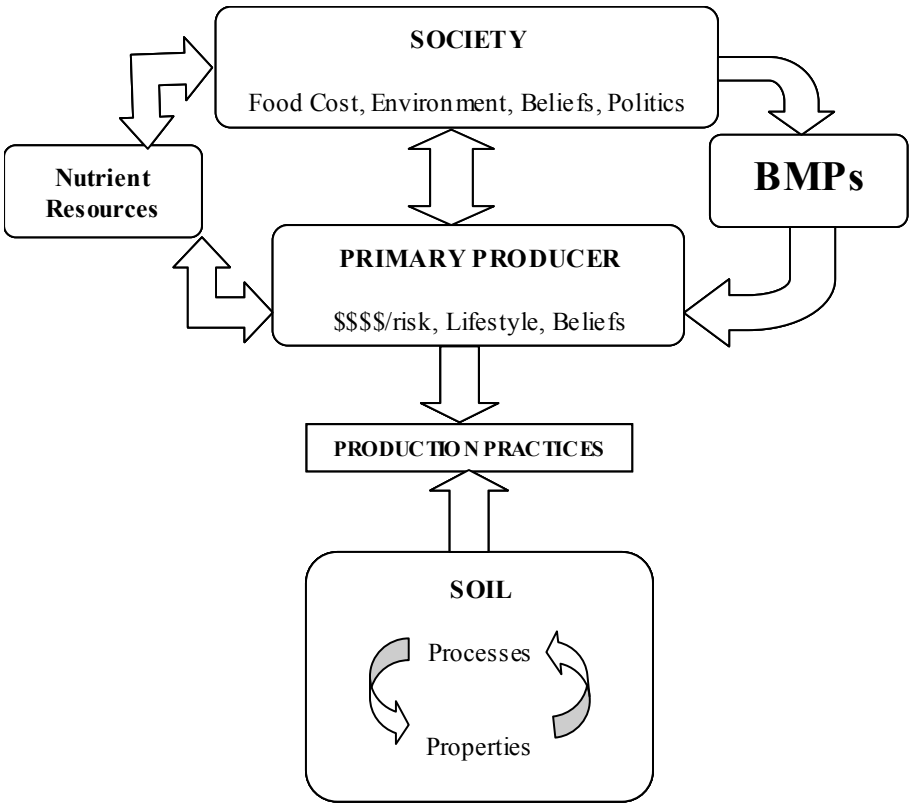

Figure 4. BMP framework partnership, the way forward.

Challenges for the Future

In Australia the changes and challenges in the production of food and fibre are likely to be in step with the rate of change in society in general. With declining rural political influence and the public expectation of cheap, clean, green, available and nutritious food, there exists a range of opportunities and challenges for the farm manager and his/her support network.

Food and fibre production needs to increase to keep pace with projected population growth, just as production efficiency needs to improve to maintain limited resources such as good quality soils, and water volume and quality. These must be achieved in the face of

- Reducing availability of suitable agricultural land
- Reducing water availability for food production
- Reducing public funding available for improving unit productivity
- Need to establish and maintain a socially acceptable production/ environment balance
- Maintaining a critical number of suitably trained agricultural and soil scientists to be able to provide intellectual horsepower to innovate and drive change.

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