STRATEGIES FOR IMPROVING THE EFFICIENT USE OF APPLIED FERTILISERS IN SUGARCANE

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The key to efficient fertiliser use, in all industries, is the old but highly relevant set of guidelines called the 4R's of efficient nutrient management – apply the Right Product at the Right Rate, at the Right Time and in the Right Place.

This may sound easy, but as the importance of each of these different aspects can change dramatically with the nutrient involved, the soil type, the crop type and the climatic conditions - not to mention the way these factors interact - you can see that there is room for inefficiencies to develop.

For example, nutrients have different mobilities when applied in soil under the same climatic conditions.

Nutrients like nitrogen (N) and sulphur (S) move readily through the soil profile when dissolved in water, but other nutrients like phosphorus (P) and potassium (K) are much less mobile due to their tendency to bind to soil particles and organic matter.

As you can imagine, how you place these immobile nutrients with respect to zones of active root growth is likely to be much more critical for successful plant uptake than for nutrients that water will re-distribute down the profile for you.

Nitrogen is probably the nutrient that presents the greatest challenges for efficient use because *(a)* it is required in large amounts by plants, and so application rates tend to be high; and *(b)* it is highly mobile in soil water (so prone to leaching or runoff loss).

It can also be lost to the atmosphere by denitrification due to microbial action under the right conditions.

Losses by any pathway indicate a poorly used fertiliser investment. But because of the cost of fertiliser relative to the price of sugar, the response from growers to ensure plants have access to adequate N is often to apply higher fertiliser rates.

While sensible agronomically, these practices can impact the environment. When lost in runoff or drainage, N can cause unwanted effects in offsite water bodies (e.g. algal blooms, prolific growth of aquatic plants) or groundwater pollution.

If lost to the atmosphere, some of the gases generated can accelerate the greenhouse effect due to their high global warming potential.

The Holy Grail for efficient use of fertiliser is to minimize the risk of offsite loss, so a grower can confidently apply only the amount of N the crop needs to meet its demands for growth, noting that these may vary between regions, blocks and growing seasons.

The greatest risk of loss (inefficiency) is when N is present in soil in nitrate form, as nitrate-N can be lost in water or as a gas to the atmosphere, rather than being stabilised in plant biomass.

The most efficient N supply is a trickle feed from soil and fertiliser that matches crop uptake requirements.

However, this is difficult in a crop like sugarcane, as the growth requirement for N uptake occurs over a 6-7 month period (which often includes the wet season) and the crop rapidly grows tall enough to prevent access by conventional tractors and fertiliser rigs about 2-3 months after emergence.

Innovations in machinery design that allow smaller applications at later growth stages (i.e., split application) are one way of trying to limit the period when excess nitrogen is vulnerable to loss in the soil.►

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The article on the high clearance fertiliser rig developed by the **Russo** family in the previous edition of Australian Canegrower is a good example.

However, in climates where access to fields can be difficult at the appropriate time because of excessive soil wetness, this alone may not always be effective.

Another approach receiving a lot of attention is using innovative fertiliser products called Enhanced Efficiency Fertilisers, or EEF's.

These products either control the rate of release of N from the granule into the soil, or alternately, slow the conversion of fertiliser N into the nitrate-N form, which can be lost through water movement or microbial activity.

Both approaches can have limitations. For example, wet soil is required for N release from a controlled release granule, so N supply can be limited in dry periods.

Products that control N transformations can be degraded by microbes, and so may not be effective for long enough.

Despite these shortcomings, the potential for combining these technologies in blends or new products holds real promise.

This research is the current focus of projects funded by state and federal agencies, The National Environmental Sciences Program and Sugar Research Australia, with support from fertiliser manufacturers and resellers.

Ultimately, the objective is to develop decision-support tools and fertiliser products that will allow industry to confidently apply the right blend of fertiliser products at the right rate and time to ensure efficient use in growing productive crops with minimal off-site impacts.

Innovative machinery to allow flexibility in time of fertiliser application, combined with fertiliser technology to control the availability of N in the soil, offer real opportunities for major advances in sugarcane N fertiliser use efficiency. ■

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