THE NEED TO IMPROVE WATER AND FERTILISER EFFICIENCY

This Insight observes the fertiliser manufacturing costs that rise with the rise in the cost of fuel and how water use efficiency and harvest index will become increasingly important to growers.
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As recently observed, the fertiliser manufacturing costs rise with the rise in fuel price.

At present one kg of nitrogen and potassium is around $1.00, and one kg of phosphorus about $4.00. While nitrogen, and to a lesser degree potassium, are subject to loss from the root zone, phosphorus is more tied up in forms that are not readily available. It is therefore essential to improve fertiliser use efficiency as well as water use efficiency, as the two are strongly inter-related.

Here I cover nitrogen efficiency benchmarks that you could relate to when you monitor yield and fertiliser management. Agronomic Efficiency (AE) of nitrogen is a function of Recovery Efficiency (RE) and the Physiological Efficiency (PE), therefore AE = RE X PE.

Recovery Efficiency of nitrogen is in the range of 0.3 to 0.8 kg / Kg applied N (e.g. 20% to 70% of applied nitrogen may not be recovered by the plant). Factors involved in nitrogen recovery include :

- quantity (rate) of nitrogen used
- timing of application
- placement method
- volatilisation
- plant density
- soil available nitrogen reserves
- soil organic matter
- climate conditions – such as moisture, wet feet, etc.

Physiological Efficiency (PE) is defined as the ability of the plant to convert nitrogen that is taken up into grain. PE ranges from 40 to 60 kg of grain per Kg of nitrogen that is taken up by plant. Thus, the nitrogen that is taken up by plant could produce some 20% more grain with better genotype (cultivar) and better management.

Given the above extreme ranges, the overall Agronomic Efficiency (AE) of the extreme scenarios is as follows :

- AE (Efficient system) = 0.8 X 60 = 48 kg grain per kg nitrogen applied (e.g. 20.8 kg of N per tonne of grain).
- AE (inefficient system) = 0.3 X 40= 12 kg grain per kg of nitrogen applied (e.g. 83 kg of N per tonne of grain).
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Recently, I came across some interesting statistics from Pakistan, in which Nisar Ahmad *(2007, IFA workshop)* shows that there is some 2.5-fold increase in nitrogen use between 1982-3 to 2004-5. Over this period, the AE of nitrogen dropped from 33 kg to 19 kg of grain per kg of nitrogen (e.g. 30 kg N per tonne of grain to 53 kg of N per tonne of grain).

Therefore, one important factor to consider in AE is that a higher nitrogen rate is associated with lower AE.

When using **BSN** and **CSF** we recommend reduction in NPK inputs, as we improve root turnover and fertiliser interception.

Root interception could easily save the farmer 20% of nitrogen and more of potassium and phosphorus. Thus, for a 2-tonne crop, fertiliser efficiency savings of nitrogen alone is around $8.00 per ha. Such savings would easily pay for **BSN** and **CSF** (foliar) in the integrated fertiliser approach that RLF customers follow.

Excess nitrogen use has adverse physiological consequences that could reduce yield.

The lost nitrogen is also a contributor to pollution as well as soil acidification, the latter costing the grower more to correct. It is likely that the US farm subsidy is going to be linked to nitrogen use efficiency, therefore the economic and environmental concerns are universal.

WATER USE EFFICIENCY and HARVEST INDEX will increasingly become important management issues now that global warming poses new challenges.