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Effective and Efficient Nitrogen Management to Support the Pillars of Sustainability

Roberto Norton (IPNI Australia)

The effective and efficient use of plant nutrients has many dimensions, including supporting environmental, economic and social goals. The complexity of outcomes is often attempted to be resolved into various nutrient performance indicators. These could include nutrient balance, nutrient productivity, soil nutrient levels and losses to the environment. The most common indicator is partial nutrient balance (PNB_N) which attempts to reconcile N removals and additions to assess trends in nutrient "efficiency". This can be estimated at a country or regional level, with often imperfect assumptions about both inputs and outputs. Some reports attempt to disaggregate values by crop or region, but most annual systems are poly-cropped, while a regional assessment can conflate quite diverse production systems. Examples of indicators assessed at different scales - national, regional, industry, crop, farm or paddock will be presented. However, in all examples, PNB_N fails to recognise the many important dimensions of nutrient efficiency and effectiveness. The importance of any indicator should be considered over several crop cycles at a farm level and should be used to develop meaningful benchmarks communicated to growers to assist them in improving nutrient management and enhancing soil health. PNB_N has been proposed as a benchmark either in policy settings or as management guides for growers but it is not an environmental indicator as it only assesses a single fate of the supplied N. It does not link to any change in soil nutrient storage and so is basically dissociated from soil fertility. It is not linked to economic goals and is dimensionless so does not consider the magnitude of any imbalance. There are significant and important limitations in using a single indicator as a measure of sustainability. Multiple indicators that include soil health, economic performance and future productivity are required to assess progress towards economic, environmental and social goals.



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