More Profit from Nitrogen

Improving dairy farm nitrogen efficiency using advanced technologies

The science of Nitrogen (N) cycling in dairy systems can be poorly understood by dairy farmers and their agronomy advisors. Consequently N supplied to the pasture through mineralisation, and the variation in this supply over seasons, is not considered in fertiliser decision making.

Undertaken by the University of Melbourne, this project aims to gain a better understanding of the amount of N supplied through mineralisation to dairy pastures under dryland and irrigated conditions in one of dairy's largest producing regions, South West Victoria. The findings will be utilised to develop a tool for farmers and advisors which will reliably estimate mineralised available N so that N fertiliser inputs can be adjusted accordingly. New N assessment technologies will also be investigated. The outcomes will provide opportunities to reduce costly N fertiliser inputs, N loss to the environment, and increase profit.

The Research Questions

- How much N is provided to high rainfall zone dairy pastures through mineralisation, and how does this vary over the year?
- Can new technologies, such as colour (NDVI) and hyperspectral imagery be used to predict N requirements of the pasture?
- Do these new technologies correlate with readily available field based tests?
- What is the benefit of using an enhanced efficiency fertiliser (EEF) program?
- Does irrigation lead to more effective utilisation of and more production of soil mineralised N?

Methodology

1. Small plot field experiments are being conducted at a commercial dairy farm located at Allansford, South West Victoria on irrigated and dryland areas. The experiment includes 5 N rates, Enhanced Efficiency Fertilisers (EEFs) and urine treatments over a 2.5 year period. Biomass, soil mineral N, N response and infield ^{15}N measurements, soil moisture and temperature, and climate conditions will be measured at both sites.
2. Laboratory experiments are also taking place to understand mineralisation and N_2 production – using different techniques including ^{15}N labelling of N pools- at the university's facilities at Parkville.
3. A range of technologies for predicting N supply are also being tested (test strips, hyperspectral cameras, mineralisation calculation).

Initial Outcomes

The dryland pasture growing season in 2017 was from late April through to the end of November (7 biomass harvests). Irrigation enabled increased annual production, with 12 biomass harvests. Preliminary results show that autumn N response curves are very flat. Between 77 and 95% of the N utilised by the pasture in autumn was sourced from the soil mineral N pool and fertiliser recovery for the same period was low (20%). These results suggest that reducing N inputs at this time of year would have little negative impact upon the productivity of both systems as the majority of N is derived from mineralised N. Autumn biomass production was greater in the dryland plots than in the irrigated plots reflecting the greater amount of stored soil profile N (76 kg N/ha compared to 47 kg N/ha over 80 cm depth respectively at the end of April).

Extending the outcomes

The project is providing opportunities for dairy farmers, service providers and extension staff to connect with ongoing outcomes via workshops and field days conducted in collaboration with local Dairy Australia programs. Initial findings were presented at a conference in the USA in 2017 and ongoing research will inform further conferer publication opportunities.

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