Soil Nutrient Management Project

Comparison of conventional and Albrecht-Kinsey fertiliser regimes on a commercial dairy farm.

Key findings

- The Albrecht-Kinsey fertiliser regime received greater fertiliser inputs which, after several years, led to higher levels of Mg, K, S and Na and lower P in the soil than conventional recommendations.
- Adopting an Albrecht-Kinsey fertiliser regime did not alter soil physical characteristics but invertebrate numbers, especially earthworms, were higher.
- The lower N inputs increased clover content of pastures on the Albrecht-Kinsey farm but this did not alter total pasture yield or quality
- Milk yield was similar under both fertiliser regimes
- There did not appear to be financial or environmental benefits from adopting the Albrecht Kinsey regime

Mission

Methven dairy farmers Casey and Solly had become interested in the Albrecht-Kinsey base cation saturation "biological" approach (A-K) as a means of sustainably managing their newly-converted dairy farms. In the absence of information on the impacts of this system in the whole-farm context, they elected to manage only one of their pair of "matched" farms under the A-K biological system, while continuing to manage the other according to conventional "good agricultural practice". A steering group of farmers, industry representatives and researchers was established in 2013 to provide guidance and support on strategy and data collection.

The project objectives were to evaluate and compare the impact of the A-K biological approach with a conventional (Con) plant sufficiency fertiliser approach on:

- Production of pasture and animals
- Health of animals
- Physical, chemical and biological qualities of soil
- Environment and nutrient losses
- Financial sustainability

What is the Albrecht-Kinsey approach?

Dr William Albrecht was a soil scientist at the University of Missouri between 1938 and 1959. One of Albrecht's students, Neal Kinsey, now currently runs his own consulting company, providing services for those who use the Albrecht approach. Albrecht championed the concept of meeting soil mineral requirements rather than plant mineral requirements as with conventional practice.

By balancing alkaline nutrients in the soil based on their nutrient holding capacity Albrecht argued this would promote a bio-active soil, increase humus, and increase the beneficial soil organisms which would in turn make minerals and nutrients more available to the plant. Using the soils cation exchange capacity (CEC) metric Albrecht concluded that the best crops were produced in a soil where the CEC was saturated to approximately 80% as Ca and Mg. Most of the research testing Albrecht's philosophy has been conducted in arable or glasshouse situations, with debate ongoing over the efficacy of this approach. With little information about the impact of using the A-K regime in a pastoral situation, the decision to test the A-K hypotheses on a commercial dairy farm was made.

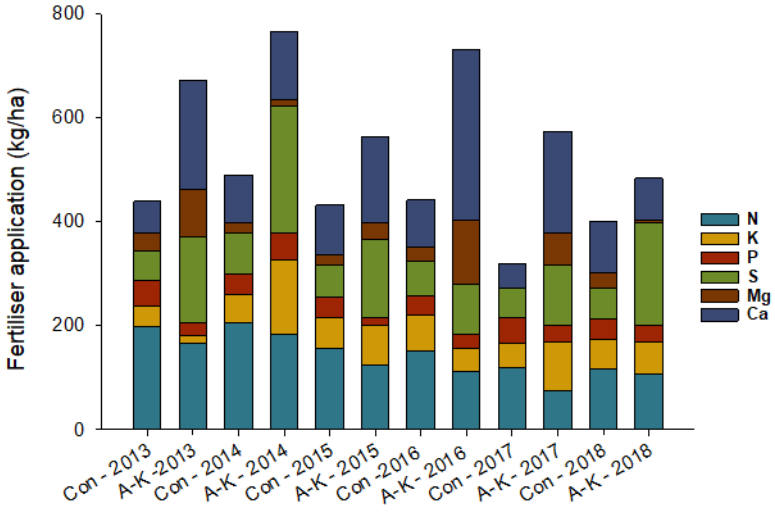

Figure 1. Application of mineral elements in fertilisers on two neighbouring dairy farms practising the Conventional (Con) or Albrecht-Kinsey (A-K) soil fertility regime.

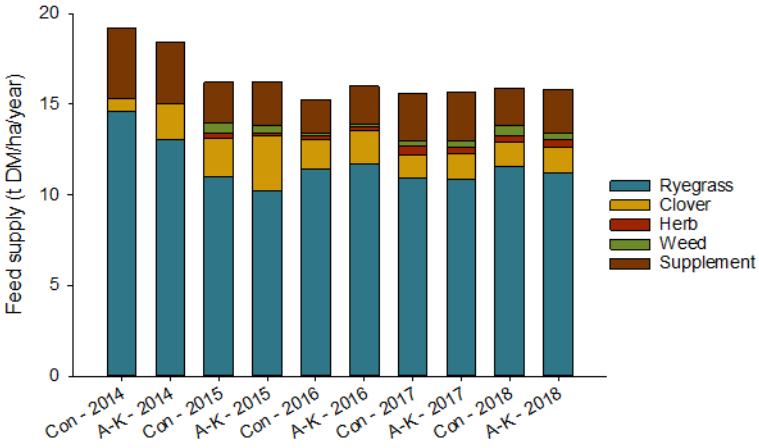

Figure 2 Pasture production and supplement use on the conventional (Con) or Albrecht-Kinsey (A-K) soils between the 2014/2015 and 2018/2019 seasons

Albrecht-Kinsey on a commercial dairy farm

The farms are located in Highbank, New Zealand (long. 43.643, lat. 171.738) on sedimentary soils. Converted to two dairy farms of 165 hectares (A-K) and 221 ha (Conventional) in 2012. Farms were sown with *Lolium perenne* and *Trifolium repens* pasture species and rotationally grazed with Friesian x Jersey cows between August and June each year when cows were moved off-farm to their winter grazing. Fertiliser recommendations were provided by Ballance Agri-Nutrients Ltd, and Healthy Soils for respective Con and A-K farms and quantities of minerals applied are shown in Fig 1.

Data was collected and analysed and modelling conducted. At the beginning of the comparison, three paddocks on each farm were paired for ongoing monitoring based on similarity in cropping history and fertility status. Seven years after the comparison commenced, soil nitrate profiles were also measured during a winter drainage period.

Production: Pasture production and supplement use have been similar for both farms (Fig 2.). There has been no difference in pasture quality or animal production. Clover content was initially greater on the A-K farm though differences have diminished over time (Fig 2.).

Soil attributes: The combined cation saturation of Ca and Mg has been similar for both farms (77±1.2%), though the A-K farm maintained greater soil Mg than the Con farm. Olsen P levels on the A-K farm have gradually declined (Hill lab result) due to lower P fertiliser. Soil physical properties remained similar between the farms though variation within years was evident. There have been greater numbers of invertebrates in the A-K farm system, which may be the product of lower N fertiliser (Fig 3) and greater clover content.

Animal Health: The livestock on the A-K farm had 1-2% greater conception rates and fewer metabolic problems during and after calving, though differences were not statistically significant.

Nutrient losses: Because pasture and animal production and supplementation have been similar for both farms the estimated N leaching from the A-K farm has been similar (Fig. 3). When differences in N fertiliser exceeded 40% estimated N leaching was greater on the conventional farm (2018/19, Fig. 3). A study of soil nitrate distribution under simulated urine patches did not provide any evidence of improved nitrogen retention within A-K soils.

Financial sustainability: Adopting the A-K fertiliser regime required more fertiliser inputs (Fig. 1) which increased expenses. Lower animal costs on the A-K farm off-set some of the fertiliser costs (which became less over time) leading to similar profitability for both farms after 4-5 years of using the A-K regime.

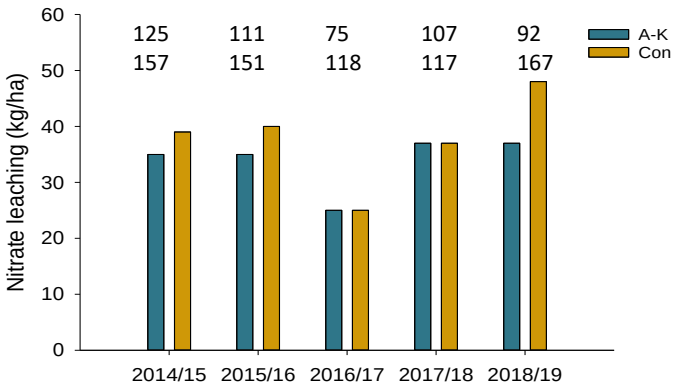

Figure 3 Nitrogen fertiliser applications (top row, kg N/ha) and OVERSEER estimate of nitrate leaching (kg N/ha) on dairy farms following either a conventional (Con) or Albrecht-Kinsey (A-K) fertiliser regime

Useful References

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