



In Australia's grazing-based dairy systems, pasture utilisation is closely linked to profitability. Kikuyu is well-adapted to subtropical areas. It is fast growing but of moderate quality and generally perceived as a grass of poor nutritive value for dairy cattle.

The Dairy UP team wanted to identify ways Australian dairy farmers could manage kikuyu pasture to improve quality and utilisation.

Timing of grazing

The timing of grazing has a big impact on kikuyu's nutritive value, which affects pasture utilisation.

Kikuyu leaves lose quality very rapidly if not consumed at the right time and the window of opportunity is generally smaller than for temperate grasses.

Grazing intervals also affect stem content. Stems are more fibrous so the digestibility and nutritive value of kikuyu pasture is reduced if there's higher stem content.

Dairy UP research

This project was designed to better understand and predict the rapid, short-term daily changes in the nutritive quality of kikuyu. The key aims were to:

- Predict short-term changes in kikuyu pasture quality in real time by modelling how the plant grows and ages.
- Measure how quickly pasture quality declines during kikuyu regrowth and identify the main factors driving that decline.

Unlocking the potential of Kikuyu

Dairy UP's PI project aimed to unlock the potential of Kikuyu pastures used by NSW dairy farmers. PI was a suite of five projects that collectively explored new management options to grow and utilise more Kikuyu over summer and increase the productivity of Kikuyu-based pastures.

PI a – Kikuyu: Remote monitoring

PI b – Kikuyu Investigating toxicity

PI c – Kikuyu: Developing New varieties

PI d – Kikuyu: Carbon on NSW dairy farms

PI e – Kikuyu: Nutritional value

This document is the final update on PI e – Kikuyu: Nutritional value.

- Develop practical benchmarks, such as leaf lifespan and the rate of fibre quality decline, to support better grazing management decisions.

Key findings

Findings from this work highlight the importance of grazing kikuyu earlier to maximise pasture quality and milk production. The project identified practical grazing targets of about 300–350 growing degree days (GDD), or 3–4 leaves per tiller, to help avoid rapid declines in digestibility during pasture regrowth.

More info

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[PI e final report](#)

Research and results

The Dairy UP team modelled changes in the nutritive value of kikuyu plants at different stages of regrowth.

They adapted a model originally developed for tall fescue and ryegrass. Plot-scale, field experiments were conducted in 2023 and 2024 to provide data to calibrate the model for kikuyu.

The model simulated changes in leaf digestibility during regrowth at different leaf stages. It accounted for leaf growth, leaf age, leaf size and nutritive value (fibre content, fibre digestibility and metabolizable energy).

Field experiments

The first stage involved three controlled field studies with small, replicated plots of kikuyu under different growing conditions in 2022, 2023 and 2024.

This enabled detailed assessment of plant morphology (structure) and nutritive value traits including age and leaf length, leaf number per tiller, fibre (NDF, NDFi) and digestibility (DMD

Key terms

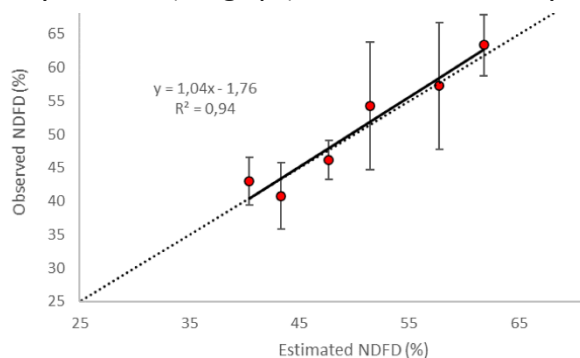
- **DMD** — dry matter digestibility (overall digestibility of the pasture).
- **GDD** — growing degree days, a measure of accumulated thermal time (heat over time) used to describe pasture development.
- **MDP model** — Morphogenetic and Digestibility of Pasture model, used to predict changes in pasture quality during regrowth.
- **NDF** — neutral detergent fibre (the fibre component of pasture; almost equivalent to the whole 'cell wall' component of the plant).
- **NDFD** — neutral detergent fibre digestibility (how digestible the fibre is for the animal).
- **NDFi** — neutral detergent fibre indigestibility (a measure of the undigestible fibre fraction in pasture; higher NDFi is associated with lower feed quality and intake).

and NDFD). This data was used to quantify, model and predict the main factors affecting the rapid decline in kikuyu nutritive value during regrowth.

Results from the first two field trials were used for model development and calibration. The last one was used to validate the model by comparing model predictions with independently observed data.

Model

The model was calibrated using data from the field trials. The quality sub-model was validated and is very accurate (see graph). The model accurately



predicted the decline in digestibility associated with leaf stage.

Growing degree days

To track pasture growth, the Dairy UP team used growing degree days (GDD), a measure of accumulated thermal time.

The GDD approach involves adding up daily mean temperatures above the minimum temperature needed for plants to grow (usually 0°C for C3 plants like ryegrass and 10°C for C4 plants like kikuyu). Being a daily measurement, it combines temperature and age effects on plant maturity and is also used to quantify measures of other things such as leaf stage interval and reproduction stimulus.

Findings

Key findings

- Kikuyu pastures showed a rapid and consistent decline in fibre digestibility (NDFD)

during regrowth, primarily driven by leaf tissue ageing.

- Changes in pasture quality were more closely associated with accumulated thermal time (GDD) than with pasture biomass accumulation.
- Leaf lifespan was quantified at about 400 growing degree days (GDD), providing a new benchmark for kikuyu pasture management.
- Leaf ageing explained about 70% of the variation in fibre digestibility (NDFD) and more than 60% of the variation in overall pasture digestibility (DMD).
- Changes in fibre concentration (NDF) were relatively small, indicating that declining digestibility of fibre, rather than fibre concentration itself, was the main driver of pasture quality decline.
- The pasture growth and digestibility (MDP) model accurately predicted changes in fibre digestibility (NDFD), demonstrating strong capacity to simulate short-term changes in kikuyu pasture quality during regrowth.

Applications and implications

On farm

The project identified practical grazing targets to help farmers maintain kikuyu pasture quality and milk production.

Findings indicated that grazing before 300–350 growing degree days (GDD), or about 3–4 leaves per tiller, is important to avoid major declines in digestibility.

New kikuyu leaves appeared about every 75 GDD, or every 2–4 days under NSW summer conditions. This suggests leaf stage may provide a practical guide for grazing timing, similar to approaches commonly used in ryegrass systems.

Previous research suggests that a 10-unit reduction in fibre digestibility (NDFD) may reduce milk production by about 2.5 kg/cow/day, highlighting the importance of timely grazing management.

Industry applications

The thresholds and modelling framework developed through this project provide new information that could support advisory services, pasture monitoring technologies and future decision-support tools for pasture-based dairy systems. Improved management of kikuyu pasture quality has the potential to improve feed utilisation

and reduce variability in milk production associated with poor pasture digestibility.

Future priorities

- Test the findings under a wider range of commercial dairy farm conditions, seasons and management systems.
- Improve the model by incorporating additional factors affecting pasture growth and quality, such as nitrogen and water availability.
- Further develop the model for integration into future digital agriculture and decision-support tools using weather data, remote sensing and on-farm pasture monitoring technologies.
- Investigate the potential application of the model in kikuyu silage systems.
- Combine pasture growth and quality predictions to better guide grazing and harvest timing decisions.

Related projects

Project P1e used data from the Dairy UP's Remote Farm Monitoring Network (P1a) and from P1c: Exploring the genetic variability of kikuyu.

The modelling work was based on earlier work that modelled changes in pasture fibre digestibility (Insua et al., 2019a) and integrated those changes with remote sensor-derived data of pasture biomass and growth (Insua et al 2019b).

Collaborators

The P1e project was a collaboration between the University of Sydney and the UIB, Argentina.

Read more

Insua J., et al. (2025) Understanding and predicting changes in nutritional value of Kikuyu. [ADSA Annual Meeting 2025](#), p175.

Insua J. R., et al. (2019a) Modeling the nutritive value of defoliated tall fescue pastures based on leaf morphogenesis. [Agronomy Journal](#), 111, 714-724.

Insua J.R.et al. (2019b) Estimation of spatial and temporal variability of pasture growth and digestibility in grazing rotations coupling unmanned aerial vehicle (UAV) with crop simulation models. [PLoS ONE 14:e0212773](#).

Delivery organisations



Department of Primary Industries
and Regional Development



Partner organisations



Additional program supporters, collaborations or partnerships

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