Project Update
P4: Feedbase – Maize for Silage

March 2024

On most Australian dairy farms, the costs associated with feed represent at least half of all expenses associated with producing milk.

Feed costs can be even higher for those milking cows in intensive Total Mixed Ration (TMR) systems or housed-cow operations.

That's why any refinements to the feed base of a dairy farm can have a huge effect on a business' profit.

Maize silage

Maize is a key component in the feed base of many TMR or partial mix ration (PMR) systems because it is a high yielding and water efficient crop.

Several research studies, including projects through the FutureDairy program, proved the water and nitrogen efficiency of growing maize in Australia. Work with farmers across the country demonstrated that maize silage could consistently yield 25-28 tonnes of dry matter per hectare when good management was combined with good water and nitrogen availability.

Unlocking the potential of maize

Dairy UP's P4 project aims to unlock the potential of the dairy feed base, with a focus on growing maize for intensive systems.

P4 is a project which integrates precision agriculture with real-time monitoring of plants and soils as well as advanced modelling to grow better forage crops and increase water and land-use efficiency.

This document provides an update on P4: Feedbase – maize for silage.

Even at maximum amounts of irrigation water applied, during trials, maize silage yielded 5 tonnes of dry matter per megalitre of water – five-times greater than the average response to perennial pastures in the irrigation region of Northern Victoria.

With no water limitation, maize for silage also yields an average of 150kg of DM per kg of nitrogen.

The quality challenge

The ingredients that determine profitable maize crop yields are clear but ensuring it is then converted to 'high quality' silage isn't as straight forward – yet.

Maize silage is made from the entire plant. Each element has differing starch, fibre, and energy.

To confuse the matter further, metabolisable energy (ME) – a traditional form of determining feed quality – isn't an accurate indication of the quality of maize silage, as the high ME of the grain (starch) can be diluted by the lower ME of the stem and leaves.

Project aim

Dairy UP researchers want to create a decision support tool to help dairy farmers with their maize silage production.

Ideally the tool would enable dairy farmers to accurately predict the quality and yield of maize silage. Through real-time monitoring of a maize crop, this tool would also allow dairy farmers to intervene throughout the life cycle of the maize plant to improve harvest potential.

Separately, researchers plan to explore other maize varieties, such as the highly digestible Brown midrib (BMR), and the interactions between genetics, the environment and management – exploring options for increased maize efficiency and profitability.

Benefits

Managed well, maize silage is an efficient use of water and nitrogen on-farm, but it's an expensive crop to plant. Tools to improve management can have a big impact on maize yield and quality and therefore the return on investment in the crop.

Understanding the potential yield and quality of the final, harvested silage will also help dairy farmers to plan in advance for their feed requirements and should decrease costs.

This work could also benefit other livestock industries that use maize silage as a feed source.

Research approach

Dairy UP researchers have conducted a literature review of previous research.

They have been calibrating a modelling tool called an Agricultural Production Systems sIMulator (APSIM) to predict the yield of a silage maize crop. The calibration used data from maize crops on research (FutureDairy feedbase data) and commercial dairy farms. The farm data was collected through remote sensing and real-time monitoring.

The next stage involved on-farm testing of the APSIM and real time monitoring as well as simulating biomass observations and predictions.

On-farm monitoring

In 2023, Dairy UP researchers evaluated 11 different maize silages across various NSW dairy farms to determine the quality of the crop. On average, grain in the maize silage was 78% starch and 14 MJ/kg DM, however, there was variation between the different maize cultivars.

Neutral Detergent Fibre (NFD) percentages varied across the rest of the plant. The cob (without the grain) was 70% NDF, while the leaf and stem were at least 60% and the grain was 8%.

Metabolisable energy (ME) of the grain was 14 MJ/kg/DM, while the rest of the plant was 8 MJ/kg DM or less.

Progress update (March 2024)

The literature review together with the research helped establish maize silage yield and quality targets while also identifying knowledge gaps.

Maize silage targets include:

- Dry matter yield: 25t DM/ha.
- Starch: at least 35% to dilute as much fibre as possible.
- Harvest index (ratio of grain to total dry matter): 40-50% can dilute the fibre in maize silage.

Gaps include:

- Uncertainty about how to accurately measure the dry matter percentage of maize silage and if a maize silage with 35 per cent or more dry matter ensures a lower NDF.
- How much does sowing time, plant density, water and nitrogen availability determine crop yield and quality?
- How are indicators of quality and yield best monitored?

The APSIM calibration has room for improvement in dryland conditions, but it provided reasonable predictions of yield and harvest index for irrigated crops across regions

DairyUP
Unlocking potential

Next steps

Researchers are evaluating the indicators of grain and starch percentages within a maize silage crop and investigating how this can shed light on yield and quality potential.

The goal is to integrate APSIM with satellite data to improve yield and quality predictions as well as dairy farmers' ability to monitor, and intervene, in the plants' growth, in real-time.

From there, a decision support tool will be created.

Collaborators

The P4 project is a collaboration between Dairy UP, University of Sydney and the NSW DPI.

Read more

Ojeda, JJ et a;. (2023) Field and in-silico analysis of harvest index variability in maize silage. Frontiers in Plant Science Volume 14

More info

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