DEDICATED CROPPING BLOCKS WITHIN DAIRY FARMS

Introduction

A number of studies have shown that:

- growing maize silage followed by a winter catch crop can significantly reduce the amount of nitrogen (N) leached.
- reducing dietary N intake can significantly reduce urinary N, one of the key sources of N-leaching on dairy farms.
- standing cows off paddocks and feeding them, enables the capture and storage of effluent which can be spread when the risk of N-leaching is low.

However, there has been no research to quantify the effect on N-leaching if all three on-farm mitigation strategies were combined. DairyNZ modellers Dr Pierre Beukes and Tai Chikazhe recently worked with Pioneer Farm Systems Specialist Ian Williams to conduct a modelling study to investigate the effectiveness of such a system from a profit and N loss perspective (1).

Method

A Waikato farm with a dedicated maize block was simulated and compared with the two Waikato P21 farmlets from a previous trial using DairyNZ's Whole Farm Model (WFM), APSIM and the Urine Patch Framework (UPF) over five consecutive seasons (2013/14 to 2017/18). The three simulated farms represented **1)** the P21 Current Farm (CF) with a stocking rate of 3.2 cows/ha, applying 125 kg N/ha fertiliser on pasture, harvesting grass silage for use during periods of feed deficits, **2)** the P21 Future Farm (FF) with a stocking rate of 2.6 cows/ha, applying 85 kg N/ha fertiliser, high genetic merit cows, imported maize grain as low-N feed, with a standoff pad, and 3) the maize silage-block farm (Future Farm Plus = FFP) with a stocking rate of 3.2 cows/ha, high genetic merit cows, applying 85 kg N/ha fertiliser on pasture, feedpad, maize silage followed by annual ryegrass grown on a dedicated block occupying 15% of the effective farm area. The annual ryegrass was harvested as silage and also fed on the feedpad. The model used a conservative 20 tDM/ha maize silage yield and a 6 tDM/ha annual ryegrass yield.

Results

A summary of results can be seen in Table 1.

Table 1. Predicted results (average ± SD) for five consecutive seasons from 2013/14 to 2017/18 for Waikato dairy systems.

	Current Farm (CF)	Future Farm (FF)	Future Farm Plus maize (FFP)
Pasture yield (tDM/ha)	16.6±0.5	14.8±0.8	15.5±0.9
Milk production per cow (kg MS/cow)	392±4	433±2	435±2
Milk production per hectare (kg MS/ha)	1,266±13	1,132±6	1,407±7
N-leaching weighted average (kg N/ha)	70±37	49±27	52±29
N-leaching reduction from CF (%)	-	31±4	26±3
N use efficiency (kg MS/kg N leached)	23±13	31±18	36±21
Profit/ha ($/ha)	3,049±2,123	2,721±2,071	2,918±2,220
Profit reduction from CF/ha ($/ha)	-	11±23	4±24

Discussion

The N efficiency (kg MS/kg N leached) of the FFP system shows that a dedicated crop block with maize silage followed by a catch crop, can recycle more N within the farm system, with more N exported as product per unit of N lost to the environment. While the FFP had higher N losses compared to the FF, there was still a 26% reduction in N lost compared to the CF. The extra feed generated from the cropping block meant that the FFP had the highest milk production both on a per hectare and a per cow basis. However, the extra costs associated with growing a crop and feeding it on a feedpad resulted in a very slight reduction (4%) in profit for the FFP when compared to the CF.

References

1 Beukes, P.; Chikazhe, T.; Williams, N. 2022. A dedicated maize block as a nitrogen leaching mitigation strategy for Waikato farms. Proceedings of the Australasian Dairy Science Symposium 2022.

Conclusion

The results from the modelling exercise shows that a farmer setting aside 15% of their farm as a dedicated cropping block can have some significant environmental benefits with minimal impact on profitability. Caveats are that the crop block should not be migrated across the farm to reduce the risk of N mineralisation, the maize should be followed by a catch crop (e.g. annual ryegrass), a feedpad is required to reduce feed-out wastage and capture effluent for recycling as a fertiliser source, and the homegrown crops are used to reduce imported feed-N