Miscanthus (Elephant grass) exhibits very low nitrogen leaching – Another option for the mitigation toolbox?

Fonterra™ Dairy for life

Jeff Brown, PhD, Senior Environmental Scientist
jeff.brown@fonterra.com

Miscanthus New Zealand

Conclusions

- Miscanthus nitrogen leaching was very low at < 0.5 kgN/ha/yr after an initial establishment phase.
- Plantations for biofuel production could supplement farm incomes and reduce overall whole farm nitrogen leaching losses.
- Miscanthus strips supporting native riparian plantings or as shelter belts may help to reduce surface runoff nutrient losses.

Introduction

Miscanthus, an Asian perennial rhizomatous grass (Fig. 1), is grown as a biofuel crop in Europe[1]. It's efficient C_4 photosynthetic pathway delivers very high dry matter yields.

Fonterra's Miscanthus investigations focus on co-firing with coal in factory boilers to reduce CO_2 emissions, however other environmental benefits are possible.

AIM: To trial Miscanthus under wastewater irrigation and measure nitrogen leaching losses

Fig. 1. Miscanthus harvest in Europe after autumn leaf drop, bales awaiting transport, Miscanthus chip or pellets for burning
[photo credits – Miscanthus NZ, info@miscanthus.co.nz]

Fig. 2. Fonterra Darfield Miscanthus (inset) at approximately ½ final growth height

Method

Fonterra owns farms near most factories to treat the factory wastewaters via irrigation on to pasture. 2 ha of Miscanthus was planted in 2011 under wastewater irrigation at the Darfield factory (Fig. 2).

Three suction cup lysimeters in the Miscanthus plot are sampled monthly for nitrate-nitrogen. A daily water balance allows calculation of N leaching.

Results and Discussion

After the initial establishment phase from 2011-2014, the nitrate measured in the suction cup lysimeters is very low (Fig. 3).

Calculated Miscanthus nitrate leaching is significantly lower than that from adjacent wastewater irrigated pastures used for cut and carry silage removals (Fig. 4).

Annual results indicate negligible nitrate losses in 2015/16 (Table 1).

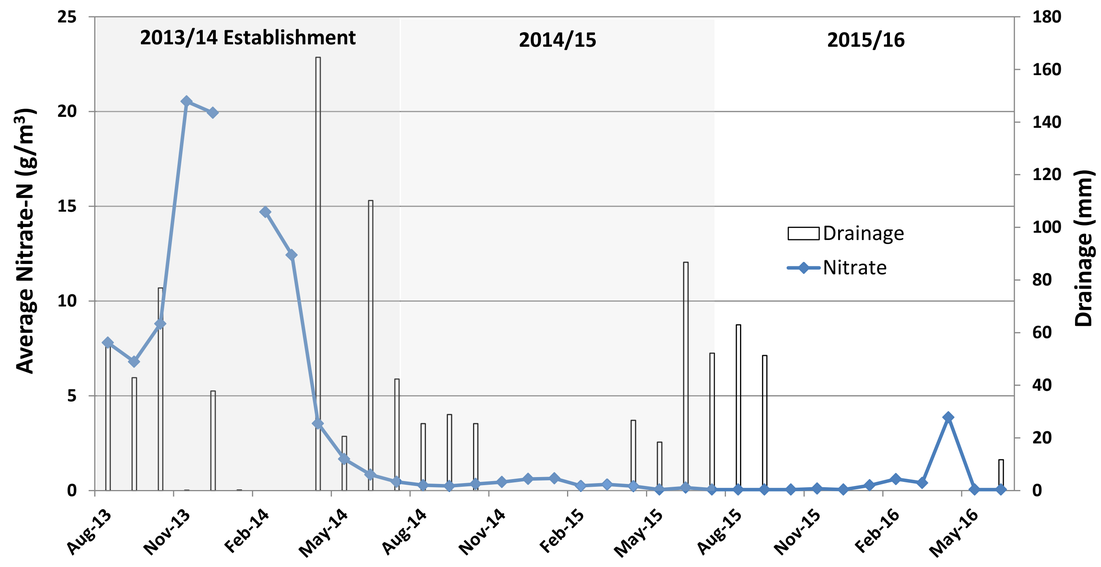

Fig. 3. Miscanthus lysimeter nitrate concentrations

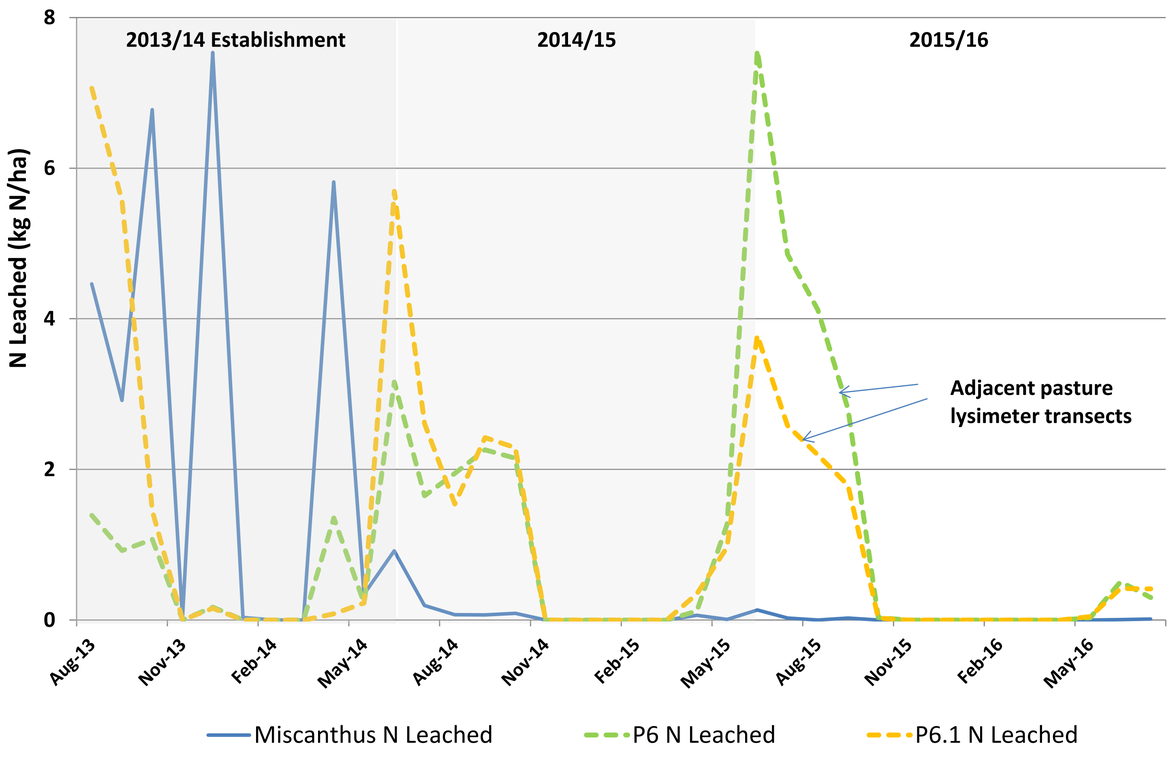

Fig. 4. Miscanthus leaching compared to adjacent pasture

Table 1. Annualised nitrogen leaching losses

	Annual Nitrogen Leached (kgN/ha/yr)		
	2013/14	2014/15	2015/16
Pivot 6	9.9	20	7.8
Pivot 6.1	23	14	4.9
Miscanthus	**29**	**0.5**	**<0.1**

Future Opportunities

Miscanthus shelter belts in Canterbury have demonstrated many positive 'ecosystem services' such as habitat for beneficial insects and increased pasture growth[2]. If a double width was planted this would allow harvest of a biofuel crop.

With a rooting depth of 2 m Miscanthus will intercept shallow groundwater. Planting in support of riparian margins may improve surface water quality.

REFERENCES: [1] Cadoux, S. et al. 2012. *Biomass and Bioenergy* 38:14-22. [2] Littlejohn, C. P. et al. 2015. *Solutions* May-June: 36-50.

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