Urinary-Nitrogen Output by Dairy Cows in Conventional and Organic Grazing Systems

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Introduction Urine from cows grazing pastures with high crude protein (CP) concentrations is the major source of nitrogen (N) leached in drainage water from New Zealand dairy farms .Organic dairy systems ,using limited fertiliser N and supplements ,are considered more environmentally friendly . This paper provides measurements and predictions of N leaching losses in a farmlet study ,comparing conventional and organic dairy systems .

Method Two 20 ha farmlets at Massey University are managed as either a conventional seasonal-supply dairy farm (C) or as a fully-certified organic system (O) .Nitrogen fertiliser is applied to C at a rate of 140 kg N/ha/year ,while O has minimal N applied as chicken manure .The average annual pasture yields are 11 .4 and 10 .3 tonnes dry matter (DM)/ha for C and O respectively .The farmlets are stocked at 2 .4 (C) and 2 .2 (O) cows/ha ,producing 409 (C) and 345 (O) kg milksolids (MS)/ cow and 980 (C) and 770 (O) kg MS/ha .Cows are grazed off-farm for six weeks from June 1st .Annual N losses in drainage water for winter-spring in 2003-2006 averaged 19 (C) and 8 (O) kg N/ha .To further investigate N leaching ,intensive monitoring of milk urea-N concentrations (an indirect measure of urinary-N output) ,cow live weight and body condition ,and pasture CP on both farmlets was carried out from September to January 2005/6 .Annual DMI intakes were estimated from 2005/6 MS yields (C : 398 ; O : 320 kg/cow) .Differences in pasture CP concentrations in other months of the year were assumed to be similar to those in the monitoring period .Urinary-N outputs were estimated by the Cornell Net Carbohydrate and Protein System model (Fox *et al* . ,2004) ,and leaching losses by the Nitrogen Leaching Estimation (NLE) model of Di & Cameron (2000) and Overseer Nutrient Budgeting software (Wheeler *et al* . ,2003) .

Results Over the five-month monitoring period (Table 1) shows decreases in dietary CP% ,(20%) ,N-intake/cow (30%) ,milk urea-N (30%) and urine-N/cow (43%) for farmlet O .In 2005/6 ,annual urine-N/ha was estimated to be 38% lower on farmlet O (Table 2) .All methods of assessing N-leaching estimated O drainage N-loss to be ~50% of that from C .

Table 1 *N intake ,urine N output and milk urea-N for monitoring period (sep-Jan* 200516) .

Farmlet		C	O
Stocking rate	(Cows/ha)	2 .4	2 .2
Milksolids Yield	(kg/cow)	288	240
DM intake	(kg/cow)	2514	2179
Dietary CP	(% of DM)	23 .4	18 .9
N intake	(kg /cow)	94	66
Mean Milk Urea N	(mmol/Litre)	5 .1	3 .6
Urine N output	(kg /cow)	50	29
	(kg /ha)	121	64

Table 2 *N intake ,urine N output and N leaching .Annual estimates* 200516 .

Farmlet		C	O
Stocking rate	(Cows/ha)	2 .4	2 .2
DM intake	(kg/cow)	4426	4120
Dietary CP	(% of DM)	22 .7	18 .6
N intake	(kg /cow)	161	123
Urine N output	(kg /cow)	90	59
	(kg /ha)	215	133
N in urine patches*	(kg /ha)	1123	742
N leached-NLE model	(kg N/ha)	15	7
N leached-Overseer model	(kg N/ha)	16	8

* Assumes urine from a cow covers ~0 .08 of the area

Conclusion Urine-N output and N leaching losses were markedly lower on the organic farmlet ,which is a reflection of the lower stocking rates ,DM intake/cow and dietary CP% compared with the conventional farmlet .

References

Di ,H J .& K .C .Cameron (2000) . Calculating nitrogen leaching losses and critical nitrogen application rates in dairy pasture systems using a semi-empirical model . N Z Journal of Agricultural Research ,43 ,139-147 .

Fox ,D .G ,L .O .Tedeschi ,T .P .Tylutki ,J .B .Russell ,M .E .Van Amburgh ,L .E .Chase ,A .N .Pell & T .R .Overton (2004) .The Cornell Net Carbohydrate and Protein System model for evaluating herd nutrition and nutrient excretion .*Animal Feed Science and Technology* ,112 ,29-78 .

Wheeler ,D .M ,S .F .Ledgard ,C .A .M .de Klein ,R .M .Monaghan ,P .L .Carey ,R .W .McDowell & K .L .Johns (2003) . OVERSEER™ nutrient budgets—moving towards on-farm resource accounting .*Proceedings of the New Zealand Grassland Association* , 65 ,191-194 .