Sustainable pastures for the high altitude Andean tropics of Colombia

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Introduction Dairy production systems in the high altitude Andean region of Colombia (>2.600 m.a.s.l.) use large amounts of nitrogen (N) fertilisation. Due to the inefficient use of N by the grass, it contaminates surface and ground water resulting in the eutrophication of lakes and rivers. It contributes to increased atmospheric NOx, greenhouse gas and acid rain. Therefore, the effect of different species of grasses mixed with *Lotus corniculatus* on N soil balance was evaluated.

Materials and methods Ten grass species were sown with *L. corniculatus* in a complete randomised block design with three replicates. An additional pasture of naturalised *Pennisetum clandestinum* fertilised with 400 kg of N/ha/year as urea was used as a control. Botanical composition, canopy biomass production and N forage concentration were measured during the dry and the rainy season on 45 days-old regrowth . The model proposed by Thomas *et al*. (1992) was used to estimate the amount of N cycled in the soil, fixed by the legume, N retained by dairy cattle and total soil N balance.

Results and conclusions The pastures with a good legume proportion and a positive N balance were the newly introduced *P. clandestinum, Bromus catharticus*, *Festuca rubra*, *F. arundinacea* and *Dactylis glomerata* cv. Knaulgrass. *P. clandestinum* fertilised (control) and that grown with the legume showed a negative N balance (Table 1).

Table 1 Nitrogen balance in pastures with *Lotus corniculatus*

Specie	Biomass production (grass+leg)	Legume proportion	N percent/MS	Amount of N (kg/ha/year)		
	(kgDM/ha/year)	(%)	(%)	Up take by plants	Recycled*	Balance
P.clandestinum (naturalised) + 400 kg N/ha	3.830 de	-	2.2	84	44	- 40 +/- 7.9
L. corniculatus + *P. clandestinum* (nat.)	4.933 d	22	3.0	148	119	- 29 +/- 3.8
P. clandestinum (newly introduced)	7.713 bc	51	3.3	254	286	32 +/- 9.7
Bromus catharticus	8.006 bc	34	2.8	224	223	- 1 +/- 8.6
Festuca rubra	10.135 a	35	2.6	263	275	12 +/- 8.2
Dactylis glomerata	6.871 c	15	2.8	192	138	- 54 +/- 2.8
Festuca arundinacea	10.440 a	42	3.0	313	334	21 +/- 9.7
Phleum pratense	8.198 bc	72	3.5	287	380	93 +/- 9.6
Anthoxantum odoratum	8.844 ab	42	3.2	283	292	9 +/- 5.1
Holcus lanatus	8.064 bc	38	2.3	185	216	31 +/- 9.7
Dactylis glomerata var. Knaulgrass	2.197 e	57	3.2	70	85	15 +/- 2.4
Festuca pratense	8.358 bc	66	2.9	242	342	100 +/- 10
Average	7.299 ***	43	2.9	212	228	

Conclusion Some introduced grasses mixed with *Lotus* have a favourable N balance in the high altitude Andean region of Colombia and the currently used *P. clandestinum* is inefficient in the uptake of applied N.

Reference

Thomas, R., C. Lascano, J. Sanz, M. Ara, J. Spain, R.Vera & M. Fisher (1992). The role of pastures in production systems. In: International Center for Tropical Agriculture (CIAT). Pastures for the tropical lowlands. Cali, Colombia, 121-144.