

Effect of chicory and plantain on cadmium levels in lambs

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Introduction Cadmium (Cd) is a widespread contaminant of soils in New Zealand due to historical use of phosphate fertilisers manufactured from rock phosphate with high levels of Cd (Loganathan *et al.* 2003). Herb forage species are increasingly used in pastures for their high nutritive value, but they are also known to accumulate high concentrations of micronutrients and, therefore, could potentially accumulate Cd. Our objective was to examine the Cd concentration in the herbage intake and liver of lambs grazing pastures incorporating chicory (*Cichorium intybus*) and plantain (*Plantago lanceolata*).

Materials and methods The experiment was at Palmerston North, New Zealand on a Tokomaru silt loam soil with a long history of annual superphosphate applications. The three pasture treatments were: herb (chicory Choice, plantain Ceres Tonic, red clover Sensation, white clover Tribute); pasture+plantain (tetraploid perennial ryegrass Stirling (AR1), white clover Tribute, plantain Ceres Tonic); and pasture (tetraploid perennial ryegrass Stirling (AR1), white clover Tribute). There were three replicates with 25 Romney ewe lambs (5 months old) and 1.6 ha per replicate. Grazing management provided ad lib intake by lambs. Hand plucked herbage samples replicating lamb intake were taken from cages after each grazing, and liver biopsy samples were taken from the same 10 lambs per replicate at the start, middle and end of the experimental period (see Table 1).

Results and discussion Cd concentrations of the plucked samples estimating herbage eaten were highest in the herb, intermediate in the pasture+plantain, and lowest in the pasture treatment ($P < 0.05$, Table 1). This result shows the herb species have a greater uptake of Cd than ryegrass and white clover (Lee *et al.* 1996). However, the Cd concentration in the liver was not different between the treatments over the two months. The lambs on the herb treatment grew at 192 ± 5.0 g liveweight/day compared with 93 ± 4.1 g liveweight/day on the other treatments inferring that their herbage and Cd intake was greater, but the extra Cd was not retained in the liver. The reason for the apparent lack of coupling between Cd intake and retention in the liver requires further investigation, but is possibly due to antagonistic effects of other trace elements, particularly zinc.

Table 1 Cadmium concentration (µg Cd/g DM) in herbage and lamb liver.

Sample Type	Sample Date	Herb	Pasture + plantain	Pasture
Herbage	22nd Feb	361 ^a	298 ^a	224 ^a
	1st Mar	506 ± 140.1	275 ± 108.4	110 ± 18.8
	15th Mar	557 ± 20.0	295 ± 61.4	121 ± 13.2
	29th Mar	657 ± 76.9	332 ± 35.9	148 ± 31.7
	12th Apr	754 ± 121.9	583 ± 47.1	180 ± 51.3
Liver	22nd Feb	137 ± 26.9	145 ± 41.8	154 ± 19.5
	13th Mar	141 ± 17.2	296 ± 40.4	227 ± 26.8
	19th April	242 ± 51.7	280 ± 56.8	290 ± 49.2

^a no replicates for first sample date

Conclusions Cadmium concentration was elevated in the pasture treatments incorporating chicory or plantain, but over two months the cadmium concentrations in the liver of lambs were not increased.

References

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