

Cadmium management in New Zealand agricultural soils

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INTRODUCTION

Soil cadmium (Cd) concentration is the primary indicator through which fertiliser-derived Cd is currently managed under the New Zealand Cadmium Management Strategy. However, limited information exists on the risks posed, and their management, in different soils particularly in relation to compliance with plant food standards and risks to pastoral systems.

OBJECTIVES

To inform further strategy development, including the development of New Zealand specific soil-guideline values, and provide recommendations to manage risk by undertaking research on:

- Cd uptake in selected food crops
- Risks to pastoral systems (Cd uptake by pasture, forage species and livestock and impact on rhizobia)

METHODOLOGY

Food crops

Soil and plant (edible portion) sam-

ples were analysed to assess
 a) Variation in Cd uptake in a range of commonly-grown cultivars of wheat, potatoes, onions and lettuce at 2-3 sites
 b) Influence of soil properties in 1-2 cultivars of wheat, potatoes, onions and spinach in the main growing areas of each crop across New Zealand (Fig 1).

Pastoral systems

Soil and plant samples were analysed to assess Cd uptake by 10 pasture/forage species.

A laboratory assay system was used to assess the effect of Cd on plant N and toxicity to white clover in the presence and absence of *Rhizobium leguminosarum* biovar trifolii.

Cadmium accumulation in recently weaned lambs were grazed on different pasture/forage species (Table 1) was assessed using monthly liver biopsies taken over four months.

MAIN RESULTS

Food crops

Mean Cd concentrations in the food crops are shown in Table 2.

Soil Cd concentrations were typically <0.6 mg/kg.

Cd uptake varied between different cultivars but was not consistent across sites.

Cadmium concentrations in 8 different lettuce types were all low (<0.04 mg/kg)

Management of Cd in potatoes and wheat appears likely to be most effectively achieved by cultivar management, given the absence of identified relationships with soil properties.

Management of soil pH may be sufficient to ensure compliance with food standards for onion.

The addition of compost may reduce Cd uptake in bunching spinach

These data were used to develop provisional soil guideline values to support compliance with food standards.

Pastoral systems

Chicory and plantain had the highest Cd concentrations, while perennial ryegrass and white clover had the lowest concentrations.

Toxicity of Cd to white clover appeared to be mitigated by rhizo-

bia. Solution Cd concentrations up to 6 mg/kg had no effect on plant nitrogen content in clover.

Cadmium was elevated in the liver of lambs grazed on feed crops with elevated Cd (chicory).

CONCLUSION

Provisional soil guideline values to support compliance with food standards (plant crops and livestock products) provides indication of the soil Cd concentrations at which risk management action should be considered.

These studies also provided insight into crop and soil property factors that may assist with identifying specific management actions.

There appears to be minimal risk of negative impact from soil Cd on the white clover-rhizobia symbiosis, and subsequent effects on plant nitrogen content.

Further investigation is required to fully establish the risk of non-compliance with livestock offal food standards and verify the wider applicability of findings from this study.

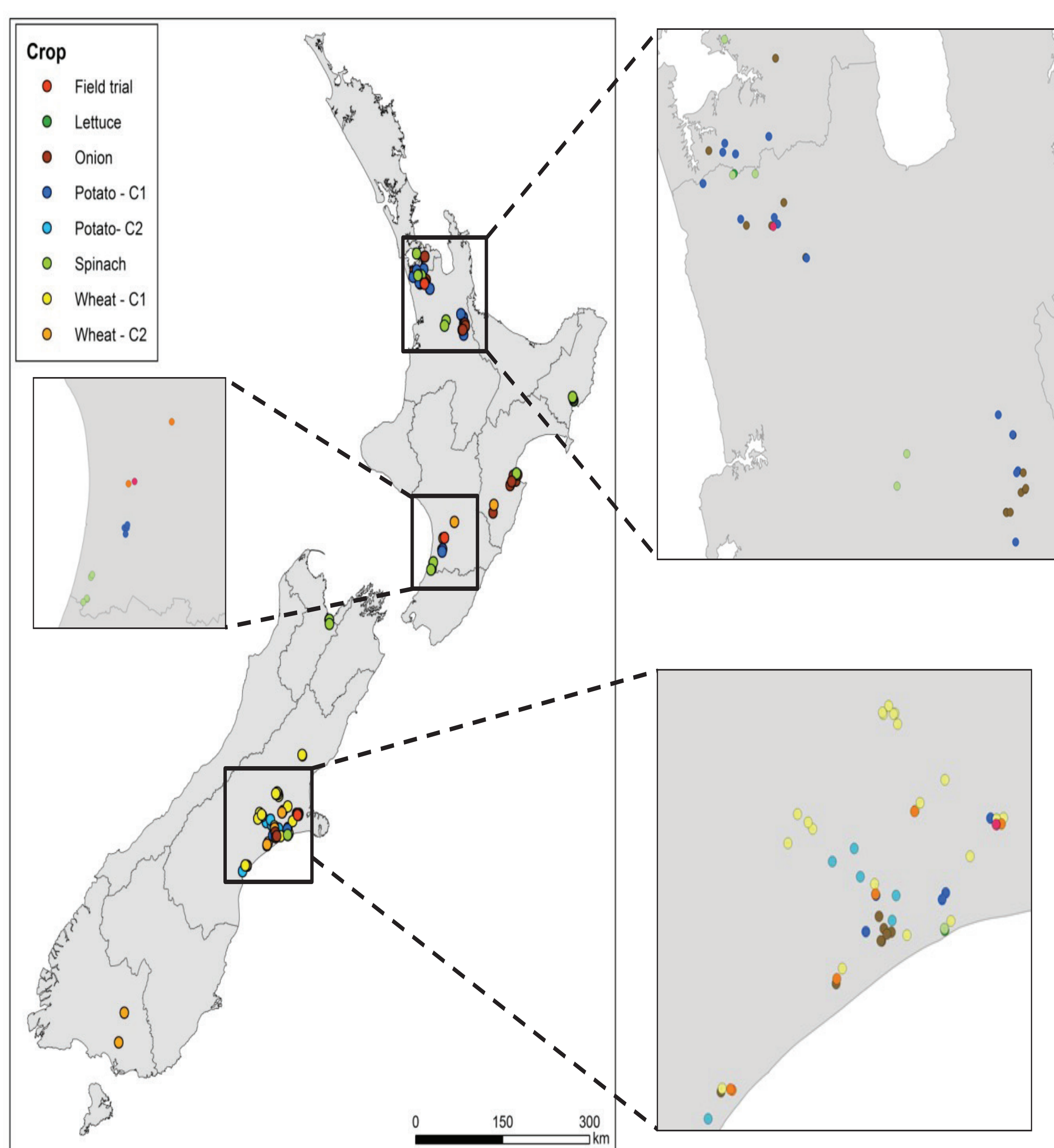


Fig. 1: Sampling location for different food crops

Table 1: Pasture/Forage crops each grazed by 15 animals

| Location | Pasture/forage crop |
|--------------------|------------------------------------------------------------------------|
| Tangimoana | Ryegrass (<i>Lolium perenne</i>), Lucerne (<i>Medicago sativa</i>) |
| Waipukurau | Ryegrass, lucerne |
| Taihape – township | Ryegrass, plantain (<i>Plantago major</i>) |
| Taihape – rural | Ryegrass, plantain, chicory (<i>Chicorium intybus</i>) |

Table 2: Cadmium concentration in the edible portion of different food crops

| Crop | Mean Cd concentration (mg/kg FW) |
|------------------------|----------------------------------|
| Wheat (site n = 33) | 0.067 |
| Onions (site n = 25) | 0.016 |
| Lettuce (site n = 6) | 0.005 - 0.039 |
| Spinach (site n = 18) | 0.06 (baby leaf), 0.1 (bunching) |
| Potatoes (site n = 35) | 0.02 |

GLOBAL SYMPOSIUM
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