

The tri-trophic transfer of Zinc to newly emerged seven-spotted ladybirds (*Coccinella septempunctata*) from sewage sludge amended soil.

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Introduction

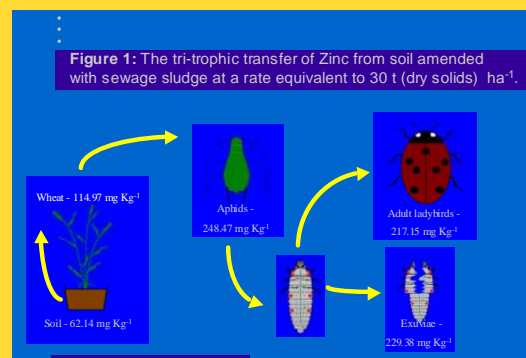
The recycling of sewage sludge to agricultural land is widespread and may introduce potentially toxic elements (PTEs), including Zn, into the food chain¹. The exposure to domestic animals and humans to PTEs is well controlled¹ but the fate of PTEs within the invertebrate component of agricultural ecosystems is poorly understood.

Methodology

Grain aphids (*Sitobion avenae* L.) were harvested from spring wheat (*Triticum aestivum* L. cv. Alexander) propagated in agricultural soil amended with sewage sludge (see Table 1). Harvested aphids were frozen until they were fed daily to fourth instar seven-spotted ladybird larvae in surplus of the larvae's daily food requirement. Feeding was continued until pupation and on emergence adults and pupal exuviae were analysed for Zn.

	0 t/ha	10 t/ha	30t/ha
Soil	42.1 ± 2.0	49. ± 2.1*	62.1 ± 3.6**
Wheat	68.9 ± 2.9	100.6 ± 5.1**	115.0 ± 1.8**
Aphids	162.9 ± 11.2	215.9 ± 12.4**	248.5 ± 11.5**
Adult ladybirds	184.2 ± 15.3	204.5 ± 13.5	217.1 ± 21.4
Ladybird Exuviae	230.5 ± 18.9	220.4 ± 14.8	229.4 ± 16.7

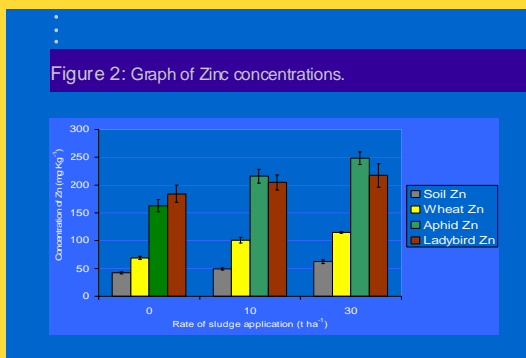
Treatments separated from the control using the Newman-Keuls procedure at 5% (*) and 1% (**) levels.



Treatment	Trophic level		
	1° Producer	1° Consumer	2° Consumer
0 t/ha	1.64	2.36	1.13
10 t/ha	2.05	2.15	0.95
30 t/ha	1.85	2.16	0.87

Results

- Bioaccumulation of Zn in wheat plants reflected the level of sludge amendment (see Table 1 & Figure 2).
- Transfer of Zn from the wheat plants to aphids resulted in the largest magnification of Zn (see Table 2).
- There was no bioaccumulation in newly emerged adult ladybirds or in their exuviae.



Discussion and conclusion

- There was no bioaccumulation from prey to predator.
- Zn levels in the exuviae did not differ significantly between treatments. This suggests that Zn is not sequestered and excluded in the exuviae during pupation.
- It was concluded that there must be another mechanism for regulating Zn body burden in the fourth instar. This mechanism is currently under investigation.

References

- MAFF, 1993. Review of the Rules for Sewage Sludge Application to Agricultural Land. Soil fertility Aspects of Potentially Toxic Elements. Report of the Independent Scientific Committee. MAFF Publications, London.