Soil acidity and management:

Increasing earthworm diversity in temperate Australian pastures

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Earthworms can significantly influence soil structure and fertility, but recent surveys of temperate pastures in southern, mainland Australia have demonstrated that the earthworm fauna is generally low in abundance and poor in diversity. Native species are rare. Earthworm communities are dominated by accidentally introduced species (mostly *Aporrectodea* spp. from Europe). The most common species are predominantly horizontal burrowers, which feed in the mineral soil layers (endogeic species). Deep-burrowing species which feed at the soil surface (anecics), are especially rare. Anecic species make up very large proportions of the earthworm faunas of temperate grasslands in other regions of the world and contribute very significantly to pasture productivity there. Anecic species play particularly important roles in the incorporation of surface organic matter and agrochemicals, and create macropores which improve aeration, water infiltration, and root penetration.

One European anecic species, *Aporrectodea longa*, is, however, common in northern Tasmania. Climatic matching suggests that *A. longa* should be able to colonise high-rainfall pastures in southern, mainland Australia if given the chance. Field trials have indeed verified *A. longa*'s ability to survive when released in high- rainfall pastures in South Australia and Victoria (where it was previously absent). *A. longa* has survived better in field cages in the short-term (5 months) than other more widely distributed endogeic species (*e.g. A. caliginosa* and *A. trapezoides*). *A. longa* has also been recovered up to 4 years after "free-range" release into pastures in SA and Victoria. These releases spanned the very dry years of the mid 1990's.

Field trials in SA and Vic. pastures have demonstrated the ability of *A. longa* to significantly improve pasture production. In cage experiments, pasture production was improved by 16 to 61% during winter to spring (5 months), depending on the density of *A. longa* used. Similar increases were achieved by introducing *A. caliginosa* and *A. trapezoides*. Glass-house experiments have shown that the improvements in pasture yield generated by *A. longa* and *A. caliginosa* are, in part, additive. This work is backed up by other studies in New Zealand, Ireland, The Netherlands and Tasmania, which have shown that the introduction of earthworms to pastures lacking them can prove highly profitable at farm-scale. For example, the introduction of *A. caliginosa* to pastures in New Zealand increased pasture production in the long-term by 25%. The introduction of *A . longa* to NZ pastures already colonised by *A. caliginosa* further increased pasture production by 20%.

Field trials in SA and Vic. have also shown that *A. longa* can have a major impact on the burial of dung (hence nutrient return to soils) and surface applied lime (reduction in soil acidity) in pastures. For example, in the presence of *A. longa*, lime moved down the soil profile to 15-20 cm depth in 5 months. The lime was probably washed down the large, surface-venting, vertically-oriented burrows this species constructs. Where earthworms were not added, the lime rarely moved below 5 cm depth in the same period.

Following on from CSIRO's earlier work in SA and Vic. (see Baker 1998 for an overview), the potential for earthworms, in particular the deep-burrowing *A. longa*, to increase pasture yield and enhance the burial of surface-applied lime is being further studied in acidic pasture soils on the Southern Tablelands of NSW This work is in collaboration with NSW Agriculture (Wagga Wagga), with funding from Acid Soil Action and LWRRDC. Surveys have recently been conducted to determine the most common species in pastures throughout the Southern Tablelands. Field trials are being run near Oolong and Neville. Also, mass-production methods are being developed for *A. longa* to facilitate its introduction into pastures in southern Australia on a broad scale.

Reference

Baker, G.H. (1998). The ecology, management and benefits of earthworms in agricultural soils, with particular reference to southern Australia. In: "Earthworm Ecology". pp. 229-57. Ed. C.A. Edwards. (*CRC Press*, Boca Raton, Florida).