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Roots and earthworms under grass, clover and a grass-clover mixture

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Introduction

In sustainable grassland the focus is on ecosystem services like soil structure maintenance and water regulation, because of the perennial nature of the crop with no regular cultivation coupled with the compaction from animal trampling and tractor usage. For these ecosystem services, roots and soil biota play an important role. When clover is introduced it is important to know which effect this management measure has on roots, soil biota and the functioning of the soil-plant system.

Materials and methods

We measured the root biomass, the abundance of earthworms and a selection of soil physical parameters in four treatments established in a completely randomized block design of six blocks:

GN1 : Grass with inorganic N fertilizer;
GN0 : Grass without N fertilizer;
GCN0 : Grass-clover without N fertilizer;
CN0 : Clover without N fertilizer.

Results

The treatment with clover-only had a lower root biomass, a higher earthworm biomass (Fig. 1), a higher number of earthworm burrows (Fig 2.) and a lower proportion of crumbs in the soil (Fig. 3), than the other treatments. This confirms the literature that pure clover stimulates the ecosystem services of water regulation, but is less conducive to soil structure maintenance. However, the grass-clover mixture did not differ significantly from the grass treatments, but differed from pure clover in a higher percentage of soil crumbs.

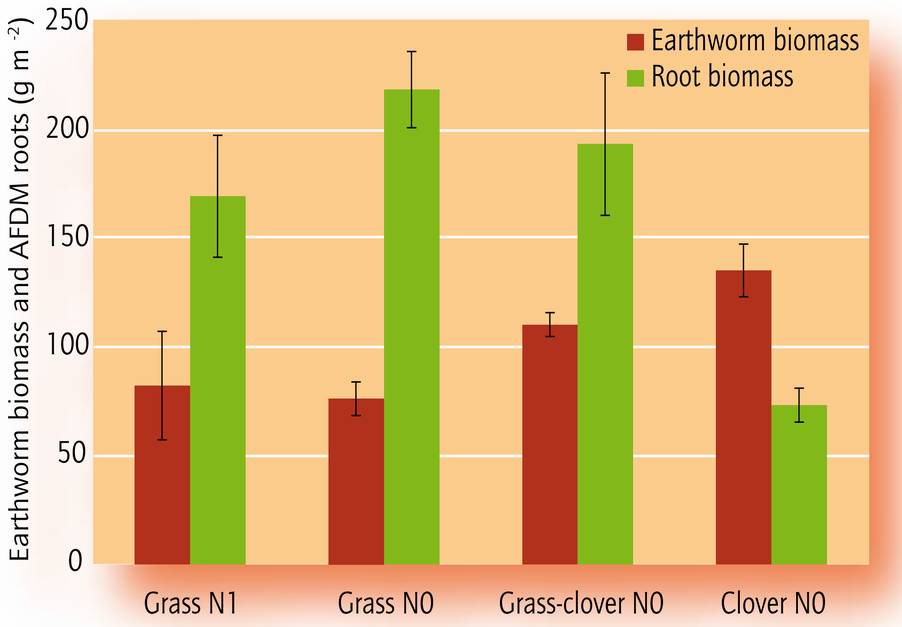

Figure 1. Earthworm biomass and Ash Free Dry Matter of roots (g m^{-2}) in grass with inorganic N fertilizer, grass without N fertilizer, grass-clover without N fertilizer and clover without N fertilizer.

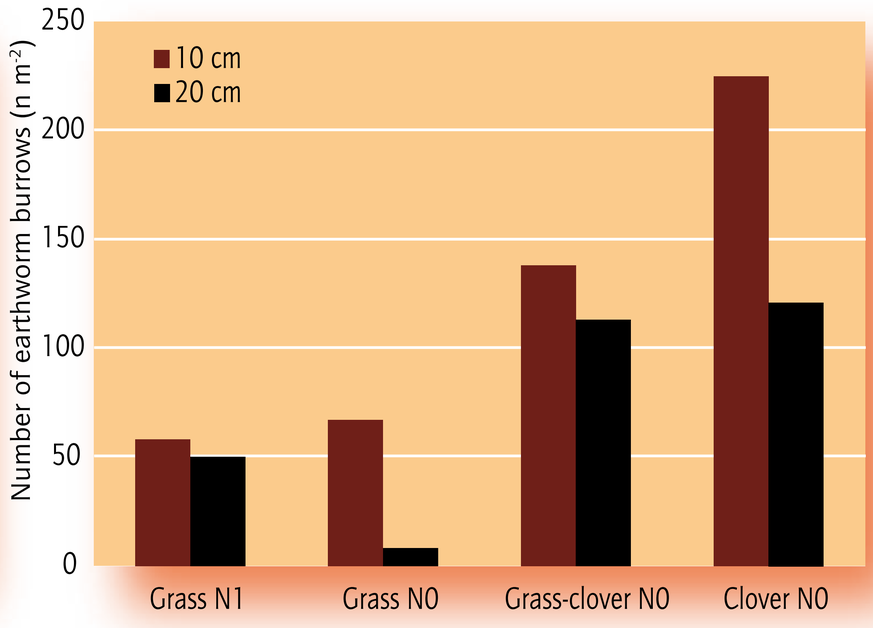

Figure 2. Number of earthworm burrows (n m^{-2}) in grass with inorganic N fertilizer, grass without N fertilizer, grass-clover without N fertilizer and clover without N fertilizer.

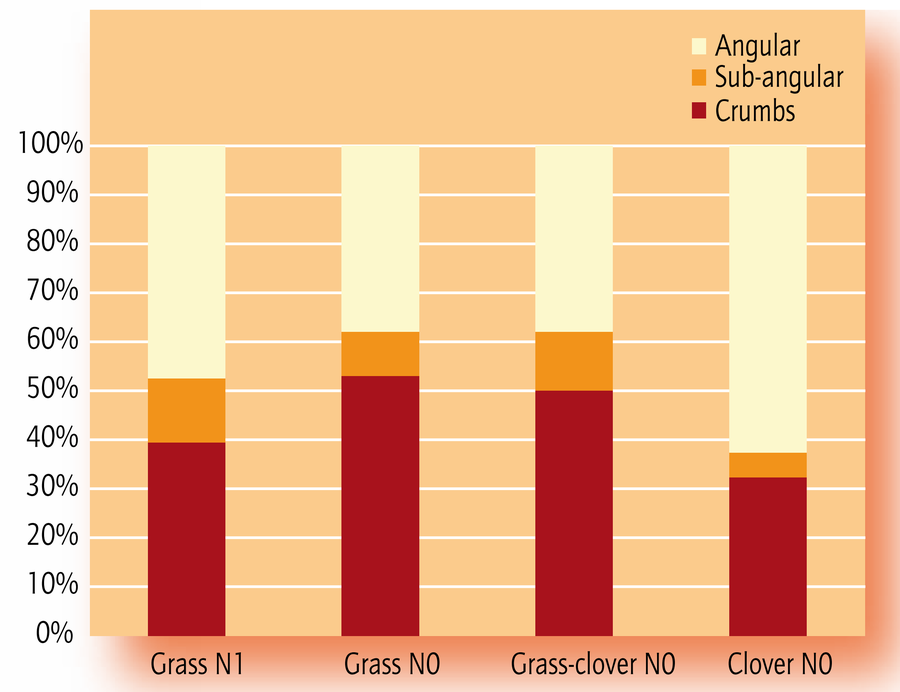

Figure 3. Soil structure 0-10 cm proportion crumbs, sub-angular and angular elements in grass with inorganic N fertilizer, grass without N fertilizer, grass-clover without N fertilizer and clover without N fertilizer.

Conclusion

We infer that, when clover is introduced in grassland to reduce the reliance on inorganic fertilizer, the mixture of grass and clover maintains the positive impact of grass roots on soil structure but only may show a positive effect of clover-only on water regulation with a higher clover percentage in the dry matter than in our experiment.

References Van Eekeren N, van Liere D, de Vries F, Rutgers M, de Goede R, Brussaard L (2009) A mixture of grass and clover combines the positive effects of both plant species on selected soil biota. Appl. Soil Ecol. 42, 254-263.