Macropores and earthworm species affected by agronomic intensification

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Background

- Biopore formation has been shown to be a pertinent result of earthworm burrowing activity and it contributes to soil hydrology: water retention and water drainage.
- The detrimental consequences of a weakened bio-functionality have been stressed in the EU Soil Strategy and hydrology in particular is affected by threats to soil biodiversity.

Methods

Earthworm burrow distribution, numbers and diameter of cross-section, was quantified at 10, 20, 30, 50 and 100 cm horizontal layer intervals down the soil profile and correlated with the earthworm community consisting of 12 species dominated by the endogeics *Aporrectodea caliginosa* and *Aporrectodea chlorotica* and the anecics *Aporrectodea longa* and *Lumbricus centralis*.

Results

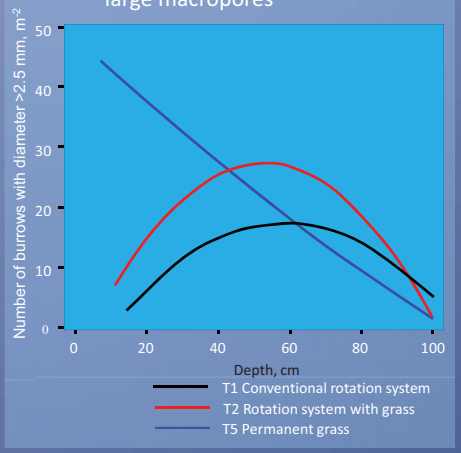
Medium-small macropores in the ploughing layer with diameters (Ø) less than 5 mm were significantly more abundant in permanent grassland compared to conventional rotation system with annual crops. An intermediate system with 3 years of grass and 3 years with annual crops was also intermediate between the two other systems. At 30 cm's depth we found no large macropores, Ø>7 mm, in the system with annuals, but increasingly more in rotations with grass. Addition of frequencies of macropores with Ø>7 mm retains the significant difference between annual and the permanent grass system. Moreover, all the large burrows, >5 mm Ø, follow this pattern and are significantly more numerous in permanent grass to annuals (P<3%).

At depth 100 cm total number of macropores were more abundant in the annual crops compared with permanent grass (P=5%), due to a larger number of macropores <7 mm.

Cropping sequences forming 3 levels of agronomic intensity

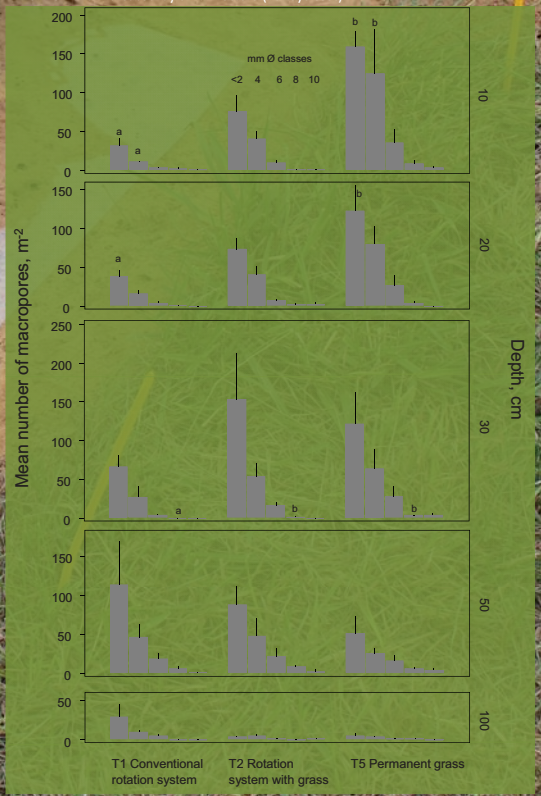
Year	T1 Conventional rotation system	T2 Rotation system with grass	T5 Permanent grass
2005	Maize	Maize	Grass
2005	Wheat	Wheat	Grass
2007	Barley	Barley	Grass
2008	Maize	Grass	Grass
2009	Wheat	Grass	Grass
2010	Barley	Grass	Grass
2011	Maize	Maize	Grass

Trends in depth distribution of large macropores



Mean number of macropores for each soil depth and agronomic intensity level separated into diameter, Ø, size classes of 0.5-3, 3-5, 5-7, 7-9, 9-11 mm.

Vertical bars are standard errors of the mean, n=4. Significant differences between macropore frequencies of crops within size-classes of each depth horizon are indicated by small letters (Tukeys test).



Conclusions

- The anecics *Nicodrilus giardi* (Savigny, 1926), *Aporrectodea longa* and *Lumbricus centralis* contribute to the large marcropores above 5 mm Ø, in all the soil depths.
- A characteristic profile of large macropores is created by the agricultural techniques, so the permanent grassland will have more macropores at the top
- of the soil, potentially forming water-drainage channels.

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