DIVERFARMING

Response of earthworm communities to crop diversification and low input management in European perennial and annual cropping systems

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Partners

Main Objectives

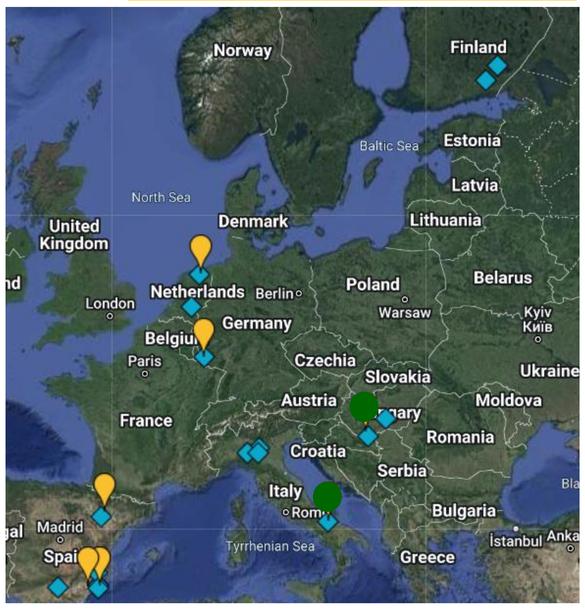
1

Development of new systems

To develop and test different diversified cropping systems (rotations, multiple cropping and intercrops for food, feed and industrial products) under low-input practices, for conventional and organic systems for field case studies to increase land productivity and crops quality, and reduce machinery, fertilisers, pesticides, energy and water demands.

Effects of crop diversification, agricultural practices and strategies on invertebrate abundance and diversity

Case studies



Methods

Strategy

Long- and short-term experiments were assessed for earthworms' abundance and diversity. Three monoliths were done per plot, and earthworms were extracted by hand sorting following TSBF method (Anderson and Ingram 1993).



Results

Long term experiments

Annual crops: horticulture in Spain (LT1), fodder crops experiment in Finland (LT7) and dairy farming experiment in the Netherlands (LT8).

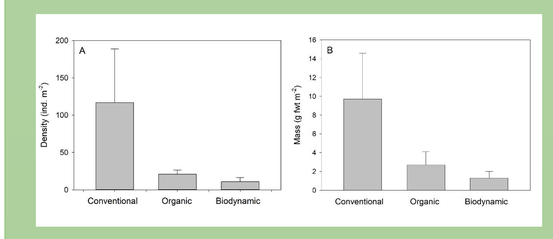


Fig. 1. Mean earthworm density (A) and mass (B) in conventional, organic and biodynamic horticulture at the long-term experiment LT1 in Spain (N=3). Vertical bars denote the standard error of the mean. There were no statistically significant differences between the treatments.

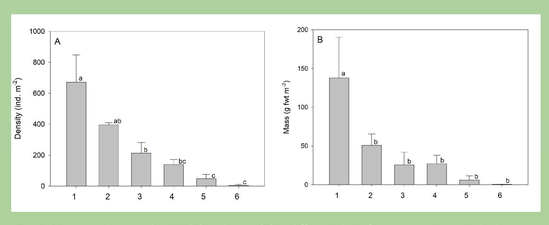


Fig. 3. Mean earthworm density (A) and mass (B) in different dairy farming rotations at the long-term experiment LT8 in the Netherlands (N=3). Vertical bars denote the standard error of the mean and different letters on the bars statistically significant differences between the treatments ($p < 0.05$). 1: Fodder crop organic, 2: Fodder crop conventional, 3: Potatoes organic 20 years, 4: Potatoes organic 10 years, 5: Potatoes conventional with mycorrhizas, 6: Potatoes conventional without mycorrhizas.

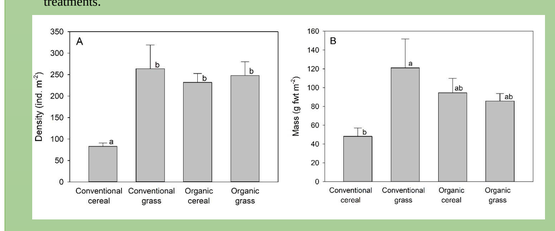


Fig. 2. Mean earthworm density (A) and mass (B) in conventional and organic fodder (grass and cereal) cultivation at the long-term experiment LT7 in Finland (N=4). Vertical bars denote the standard error of the mean and different letters on the bars statistically significant differences between the treatments ($p < 0.05$).

Perennial crop: Vineyard in Germany (LT5).

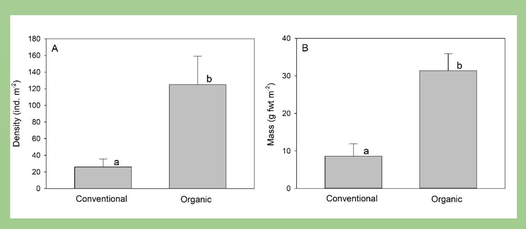


Fig. 4. Mean earthworm density (A) and mass (B) in conventionally and organically cultivated vineyards at the long-term experiment LT5 in Germany (N=5). Vertical bars denote the standard error of the mean and different letters on the bars statistically significant differences between the treatments ($p < 0.05$).

Short term experiments

Earthworms' species: a) Allolobophora chlorotica; b) Aporrectodea caliginosa; c) Aporrectodea rosea; d) Lumbricus castaneus; e) Lumbricus rubellus; f) Lumbricus terrestris; g) Satchellius mammalis

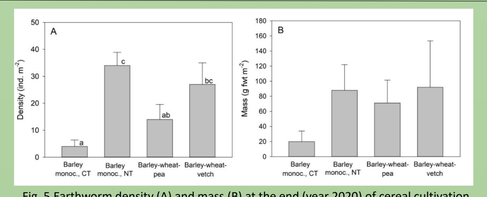


Fig. 5.Earthworm density (A) and mass (B) at the end (year 2020) of cereal cultivation experiment CS3 in Spain. NT = no till, CT = conventional tillage, ploughing. Vertical lines denote standard error of the mean (N=9) and different letters on the bars statistically significant significant differences

Fig. 6. Earthworms' biomass per treatment at fodder crops experiment CS8 in the Netherlands, significant differences observed when no separation per year is done.

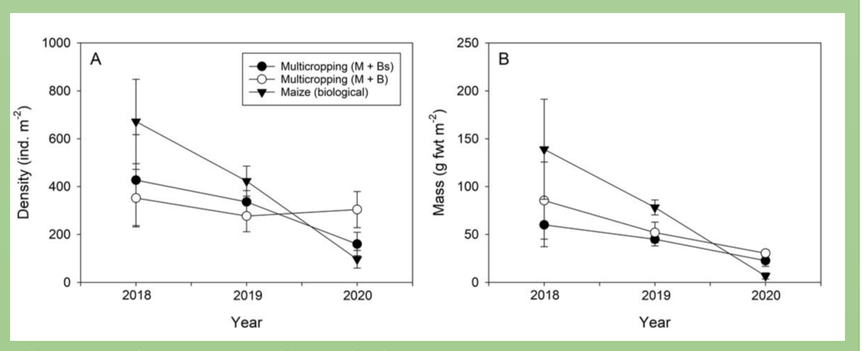


Fig.7. Temporal change of mean earthworm density (A) and mass (B) at fodder crops experiment CS8 in the Netherlands. Vertical lines denote standard error of the mean, N=3.

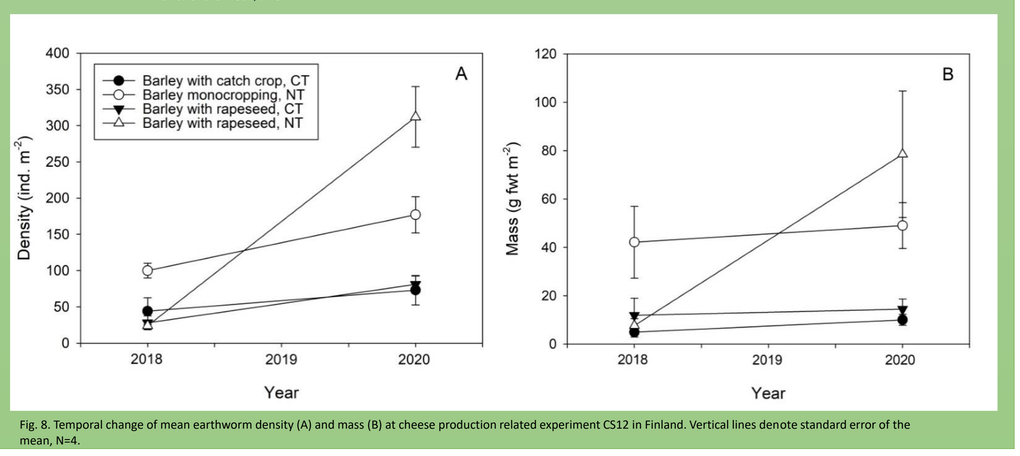


Fig. 8. Temporal change of mean earthworm density (A) and mass (B) at cheese production related experiment CS12 in Finland. Vertical lines denote standard error of the mean, N=4.

Conclusions and challenges

Diversification above ground enhances earthworm's biomass, density and richness when environmental conditions allowed it. Long term experiments provided the highest numbers. In the Netherlands, several drought periods occurred, and lower values were found when comparing among years.