PROJECT GUIDELINES INTEGRATED PEST MANAGEMENT IN SUGAR BEET

Response of biological activity of edaphic community on herbicide application intensities within a conventional and a reduced tillage system in sugar beet crop in Germany

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Introduction

Soil ecosystem services in agriculture contribute to crop yield and thereby to income. The value of this service is driven by many essential natural functions of edaphic community and its biological activity. The objective of this study was to elucidate the response of biological activity of soil organsims to herbicide application based on a broad-scaled variation of tillage and diverse sites. The performance of decomposition and feeding activity of edaphic community was screened by mini-container test (Eisenbeis, 1993) and bait-lamina assay (von Törne, 1990) in quatitative approach.

Materials & Methods

Information about site, cultivation, and field designs can be taken from the poster Marwitz & Ladewig "*Response of earthworm population on herbicide application intensities within a conventional and a reduced tillage system in sugar beet crop in Germany*".

➢ mini-container system and experimental setup

- PVC-bar as carrier with six mini-containers (MC) evenly distributed over length of bars
- the MC is a combination of a central body and each end is covered with plastic gauze discs fixed with two rings
- 150 to 350 mg of test substrate (chopped fine wheat straw) was used to fill a MC which is closed with mesh size of 2 mm (species-specific test)
- Measurement of the mass loss of substrate up to 12.3 cm soil depth
- vertical inseration with a spiral borer at six sites
- placing of four bars per plot (96 per site)
- four month exposure time (spring to early autumn)

➢ bait-lamina assay and experimental setup

- small bait portions (cellulose microgranular, bran flakes powder, and active coal) fixed in 16 conical holes pierced in PVC strips
- determination of feeding activity up to 7,5 cm soil depth as non specific species test
- vertical inseration into soil layers with scoop at 19 sites
- base-groups of 4 x 4 strips per plot (a total of 384 per site)
- date of exposure nearly four months after application of herbicide strategies
- removal time depends on perforation rate observed in control strips (10 % to 40 %)

Results & Discussion

Feeding activity and mass loss showed highest significant influence by environment, tillage system, and horizon, however not for herbicide strategy (Table 1). For both screening tests results are quite similar, therefore, further results only show effects on feeding activity. Feeding activity decreased with increasing soil depth across environments (Fig.1A), although depending on tillage rather than on environment. Feeding activity between environments showed the highest differences with more than 50 % in the upper and 40 % in lower soil depth. A depth gradient of feeding activity was recorded for both tillage systems, being stronger in the mulching compared to the ploughing system in the top 3.5 cm of soil (Fig. 1B). The feeding activity was not significantly affected by herbicide strategies in the upper or lower soil depth (Fig. 1C).

Table 1: Mass loss and feeding activity as affected by herbicide strategies (HS) and other factors with their interactions, Germany 2008/2009. Analysis of variance (mixed model) and post hoc multiple comparison (Tukey and Kramer adjustment)

factor	parameters			
	d.f.	mass loss (n = 3456)	d.f.	feeding activity (n = 7292)
environment[a]	5	***	18	***
tillage system[b]	1	***	1	***
HS[c]	2	n.s.	2	n.s.
horizon[d]	5	***	15	***
environment x tillage system	5	***	18	***
environment x HS	10	**	36	***
environment x horizon	25	**	270	***
tillage system x HS	2	n.s.	2	***
tillage system x horizon	5	***	15	***
HS x horizon	10	n.s.	30	n.s.
environment x tillage system x HS	10	***	36	***

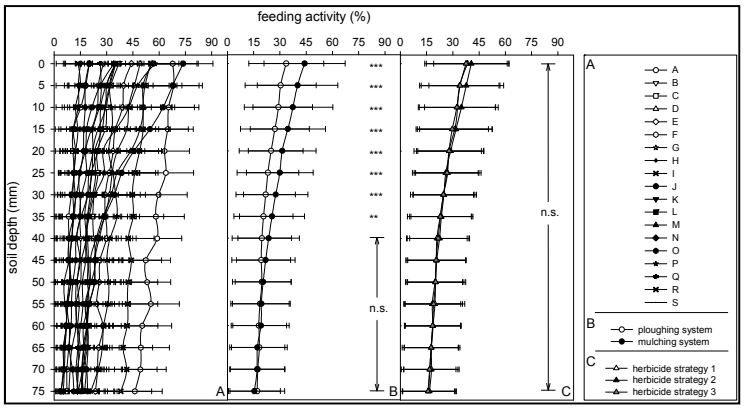

Fig. 1: Feeding activity in a vertical distribution in vegetation of sugar beet as affected by environment (site x year) (A), tillage system (B), and herbicide strategy (C), Germany 2008/2009. Means and standard deviations for (A) n ≥ 380, (B) n ≥ 3644, and (C) n ≥ 2428. Significance of differences ascertained by Tukey and Kramer adjustment. Significance: ** at p ≤ 0.01 and *** at p ≤ 0.001, n.s. = non significant.

Biological activity of edaphic community (soil invertebrates) is very sensitive to a vast array of environmental factors like soil properties (*e.g.* temperature, moisture) when performed *in situ*. Moreover, stratification of organic matter affects the activity of soil organisms which was shown by comparison of tillage systems. The higher activity in upper soil depth in the mulching system maybe induceded more favourable soil conditions (such as porosity and soil structure). Furthermore, improved nutrient availability may be attributed to higher activity. The huge variance between environments and tillage systems did not mask the effects of herbicide strategy intensities, it rather emphasised the fact of their negligible impact.

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