APPLIED PLANT RESEARCH
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The dynamics of ground-dwelling spiders in two six years crop rotation systems: sources and sinks?


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Objective

We present some results of a six year study in two farming systems and explores the question whether field margins act as “sources” or “sinks” in space and/or time for ground-dwelling spiders.



Materials & Methods

Details of this study are given in Van Alebeek et al. (2003, 2006, 2008). We compare a 10 hectare organic arable farming system “enriched” with a network of perennial field margins (21% of total surface) surrounding crop fields of different sizes with a similar 10 ha system with few margins (5%) between large fields. A full crop-rotation period (2001 – 2006) is used for statistical analyses. Pitfall traps were used in crops and field margins in 70 locations from late May until October. Here, we focus on ground-dwelling spiders caught in pitfall traps (Araneae; predominantly dwarf spiders, Erigonidae) (28% of total catch) and present results as numbers caught / trap / 14 days, per crop, year, field size, etcetera.

Results

Question 1: Do crops influence activity-density in crops or surrounding field margins during the growing season?

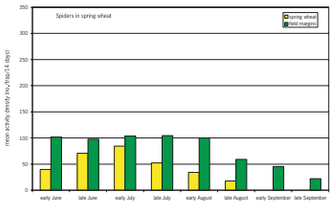

Figure 1A. Spiders in spring wheat and surrounding field margins from June to September (6 years’ averages).

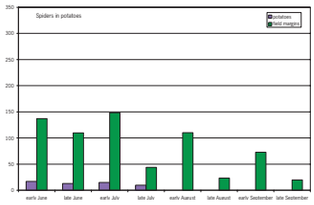

Figure 1B. Spiders in potatoes and surrounding field margins from June to September (6 years’ averages).

Mean spider activity-densities in the field margins appear more or less constant over the growing season (maxima around 100 /trap/14 days).
Spiders seem to prefer the field margins over the crop habitat of spring wheat and potatoes, other than carabid beetles.
Thus, field margins may act as (moderate) sinks for spiders during summer.

Question 2: Does field size influence activity-density in crops or surrounding field margins?

We compare activity-densities in different crop field sizes with catches in the surrounding field margins (21%) and in the large reference fields (Fig. 2).
Small fields are 35 x 50 m, medium fields 50 x 60 m, and large (reference) fields 110 x 130 m. The reference large fields have 5% surface of surrounding field margins, other fields have 21% surface of surrounding field margins.

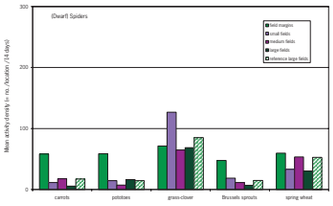

Figure 2. Spiders in crop fields of different sizes and the surrounding field margins.

Field size appears of little importance. Spiders clearly prefer the field margins habitat (or the much similar grass-clover crop) over crop habitats. Thus, field margins may act as sinks for ground-dwelling spiders during the growing season.

Question 3: Do populations of spiders ‘carry-over’ from one year to the next year in each field?

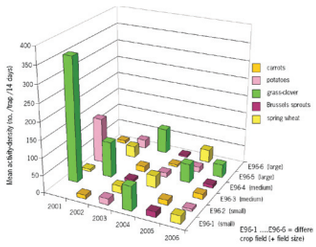

Figure 3A. Spiders trapped in different crops, field sizes and years (in the farming system with 21% surrounding field margins).

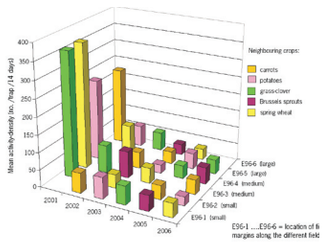

Figure 3B. Spiders trapped in the field margins surrounding the different crop fields of Fig 3A (left).

Spider populations were extremely high in the first season (2001) following field margin establishment. In subsequent years, ground-dwelling spider populations were much lower, bur rather stable. Spider populations within single fields (rows in Fig. 3) fluctuate rather little between years (and crops), compared to carabid beetles. High activity-densities in one field in one year do not lead to high catches in the next year in the same field.

Conclusions

- Crop type (with its associated variables) has little influence on the activity-density of ground-dwelling spiders during the growing season, with the exception of grass-clover, a habitat very similar to grassy field margins.
- Ground-dwelling spiders much prefer the grassy field margins and grass-clover over (other) crop habitats
- For spiders, field margins may act as (moderate) sinks during the growing season.
- High activity-density in one field in one year does not carry-over to the next year in the same field.
- Activity-density of ground-dwelling spiders is relatively constant in field margins over the season and over subsequent years. Thus, in cases of (catastrophic) depletion of spider populations within crop fields (e.g. due to agronomic practices), re-establishment may come from the surrounding field margins.

References

Van Alebeek et al., 2003. IOBC / WPRS Bull. 26(4): 185-190.
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