



The dynamics of carabid beetles 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 explore the question whether field margins act as “sources” or “sinks” in space and/or time for carabid beetles.



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 carabid beetles (Col.; Carabidae) (42% of total catches) 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 and surrounding field margins during the growing season?

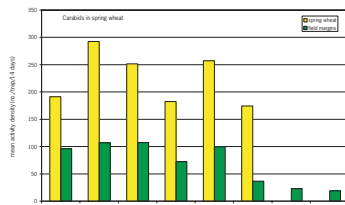


Figure 1A. Carabids in spring wheat and surrounding field margins from June to September (6 years' averages).

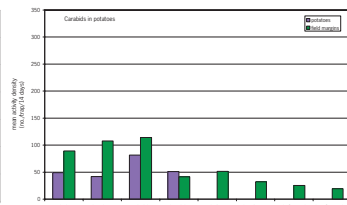


Figure 1B. Carabids in potatoes and surrounding field margins from June to September (6 years' averages).

Average carabid activity-densities in the field margins appear more or less constant over the growing season (maxima around 100 /trap/14 days), irrespective of the neighbouring crop.

Thus, in cases of (catastrophic) depletion of carabid populations within crop fields (e.g. due to agronomic practices), field margins may act as sources for re-colonisation.

In spring wheat, carabids are caught about twice as much in the crop than in the margins, but in potatoes that is the reverse.

References

- Van Alebeek et al., 2003. IOBC / WPRS Bull. 26(4): 185-190.
- Van Alebeek et al., 2006. IOBC / WPRS Bull. 29(6): 137-140.
- Van Alebeek et al., 2008. IOBC / WPRS Bull.

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 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.

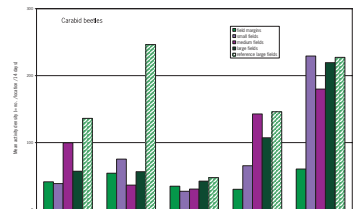


Figure 2. Carabids in crop fields of different sizes and the surrounding field margins.

Crop type (with its associated variables) is the most important factor for the activity-density of carabids, more than field size. In potatoes, large reference fields (with 5% margins) have significantly more carabids than large fields with 21% margins. This suggests that, in potato, field margins appear to function as a sink for carabids.

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

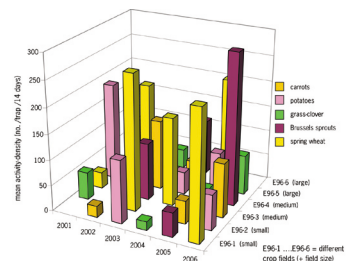


Figure 3A. Carabids trapped in different crops, field sizes and years (in the system with 21% surrounding margins).

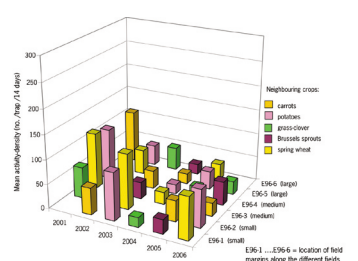


Figure 3B. Carabids trapped in the field margins surrounding the crop fields of Figure 3A (left).

Carabid populations within single fields (rows in Figure 3) fluctuate widely between years, mainly in response to crop type. High activity-densities in one field in one year do not lead to high catches in the next year in the same field. However, high activity-densities of carabids in spring wheat and potatoes (Fig. 3A) seem to ‘spill-over’ to the field margins around these crops (Fig. 3B) in the same season. For carabids, field margins appear not to act as sources or sinks during the growing season.

Conclusions

- Crop type (with its associated variables) is the most important factor for the activity-density of carabid beetles during the growing season.
- For carabids, field margins do not clearly act as source or sink during the growing season, perhaps with the exception for potato fields, where field margins may function as a sink.
- Highest activity-density of carabids was found in spring wheat crops and potato fields. This activity-density seems to ‘spill-over’ to the surrounding field margins.
- High activity-density in one field in one year does not carry-over to the next year in the same field.
- Activity-density of carabid beetles is relatively constant in field margins over the season, over neighbouring crops and over subsequent years. Thus, field margins may act as sources for re-colonisation of crop fields by carabids.