

Goal conflicts in long-term cropping system trials – the example of carrots

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Good nutrient management ↔ Good economy

Intensive cropping systems ↔ Nematode control



Implications

Agricultural research on multiple cropping systems in parallel increases the potential for knowledge transfer between organic and conventional systems. This project aims to develop cropping systems towards greater sustainability through work in long-term trials that have a unique opportunity to contribute to a holistic research perspective.

This poster presents preliminary results from cultivation of carrots as an example to demonstrate goal conflicts in organic and conventional systems between good nutrient management and good economy on one hand and nematode control and intensive cropping systems (good short-term economy) on the other.

The conclusion is that more research on nematode susceptibility and propagating at different crops and varieties is very important.

Background and Objectives

In 1987 three long-term cropping trials were set up in north and eastern Skåne. One of these trials (Önnestad) is still running, but the objectives have changed, with the main aim now being not system comparisons, but system improvement according to the unique conditions.

Key results and Discussion

The data presented are preliminary results for the fourth crop rotation (2007-2012).

Average yield of carrots for the whole rotation (before sorting) was 113 ton/ha in the conventional treatment A. Organic cropping in treatments C and E produced 84 and 78% of the conventional yield (Fig. 1.). Carrots were grown in A, C and E after beetroot, ley and red clover resp. The mineral N content in the topsoil (0-60 cm) in late autumn (=risk of N losses) was high after carrots grown after ley or clover: 44, 143 and 64 kg NO₃+NH₄-N/ha in A, C and E, respectively, compared with the mean for these treatments (46, 53 and 48 kg NO₃+NH₄-N/ha respectively). These high values were surprising, since the carrot growing season is long, carrots are known to have a deep root system, they were assumed to empty the soil of mineral-N and the fertilisation rate was moderate.

To reduce the risk of N losses black fallow has been excluded, which means a potential risk of increasing the nematode *Meloidogyne hapla* in the cropping systems. Analyses in spring 2012 showed that levels of *M. hapla* were high or very high, on average for the crop rotation 270, 100 and 709 nematodes/250 g soil for treatments A, C and E, respectively. The highest levels were found in plots where carrots were grown (95, 450 and 4000 for A, C and E, respectively). When *M. hapla* infect carrots, they restrict growth and the roots become deformed (Potter and Olthof 1993). On analysing the carrots after harvest, it was clear that *M. hapla* had caused damage to the marketable crop (Fig. 2).

How work was carried out

- Five 6-year cropping systems.
- Every crop is grown every year – 30 plots, each 12*15 m.
 - A Conventional cropping without animals.
 - B Conventional cropping with ley and manure (with animals).
 - C Organic cropping with ley for biogas production and digestate.
 - D Organic cropping with ley and manure (with animals).
 - E Organic cropping without animals

Crop rotation and yields

Crop rotation for the five cropping systems. Yields for 2007-2012 (ton/ha, dt/ha or kg/ha).

A	B	C	D	E
Carrot	Beetroot	Carrot	Beetroot	Carrot
85	72	54	64	56
Leek	Oats	Barley	Oats/pies	Green manure
94	64	48	46	5.7
Potato	Potato	Leek	Potato	Leek
44	44	71	37	68
Rye	Barley	Oats	Barley	Barley
72	62	50	46	37
Red clover	Ley I	Ley I	Ley I	Rye
530	11	8.0	10	39
Beetroot	Ley II	Ley II	Ley II	Red clover
76	11	8.4	11	320

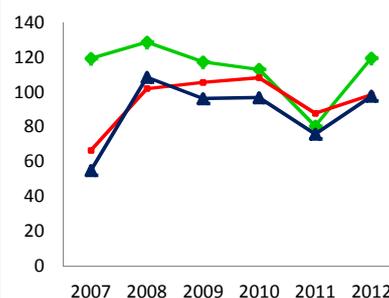


Fig.1. Carrot yield before sorting (ton/ha).

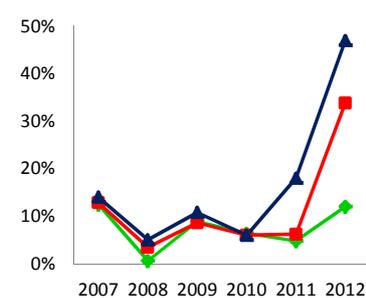


Fig.2. Proportion of deformed carrots.

References

Gissén C and Larsson I 2008. Environmentally friendly and sustainable cropping systems 1987-2005. Rapport 2008:1. SLU.
The results from all study years are available in databases at www.odlingssystem.se.