Effect of rotation crops on plant-parasitic nematodes in a former strawberry field

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Objectives

To evaluate different rotation crops for their ability to suppress plant-parasitic nematodes in strawberries.

Figure 1. Broccoli plots in rotation crop experiment. Sweet corn to the left.

Methods, field trial

Six crop rotation sequences were conducted in a replicated small plot trial in a former strawberry field with nematode problems in Hudsonville, MI. The rotations were initiated in 2009 and were compared to fallowing with tilling for weed control. Winter rye was planted in the fall in annual crop sequences. Nematode samples were taken in August 2010 and 2011. Plots were hand-weeded as needed. In mid-August, broccoli plants were chopped and incorporated in the soil. Half of each broccoli plot was covered with a plastic sheet to trap biofumigant gases released from the decaying broccoli. The plastic sheets were removed a month later. Nematodes were extracted and quantified as described above. Data were analyzed via ANOVA and mean separation procedures.

Table 1. Rotation crops planted in a former strawberry field with nematode problems in Hudsonville, MI. Winter rye was planted each fall in annual crops.

Rotation	Year 1 (2009)	Year 2 (2010)	Year 3 (2011)
Fallow	Fallow	Fallow	Fallow
Alfalfa	Alfalfa	Alfalfa	Alfalfa
Broccoli	Broccoli, then rye	Broccoli, then rye	Broccoli, then rye
OJcOr	Oats/June clover, then rye	Oilseed radish, then rye	Oilseed radish, then rye
RsPmCm	Rapeseed, then rye	Pearl millet, then rye	Chinese mustard, then rye
BrPuSc	Broccoli, then rye	Pumpkin, then rye	Sweet corn, then rye
ScPuBr	Sweet corn, then rye	Pumpkin, then rye	Broccoli, then rye

Methods, greenhouse trial

Plants were grown in pots in the greenhouse for 60-90 days, incl. marigold, squash, oat, rye, barley, pearl millet, sweet corn, hairy vetch, rapeseed, broccoli, soybean, june clover, sorghum-sudan grass, oilseed radish, buckwheat, switchgrass, forage pea, pumpkin and alfalfa (5 pots per treatment). Nematodes (root lesion and northern root knot) were applied after plant establishment. At the end of the experiment, nematodes were extracted from soil and plant roots. Data were analyzed via ANOVA

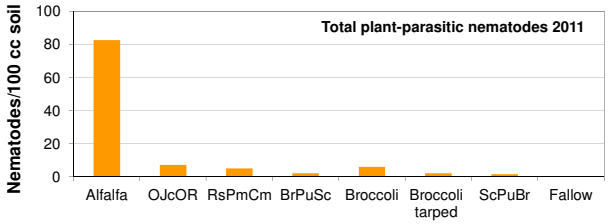

Figure 2. Effects of 3-year crop rotation on total nematode populations (90% ring nematodes plus some spiral , root lesion, and needle nematodes) in a former strawberry field.

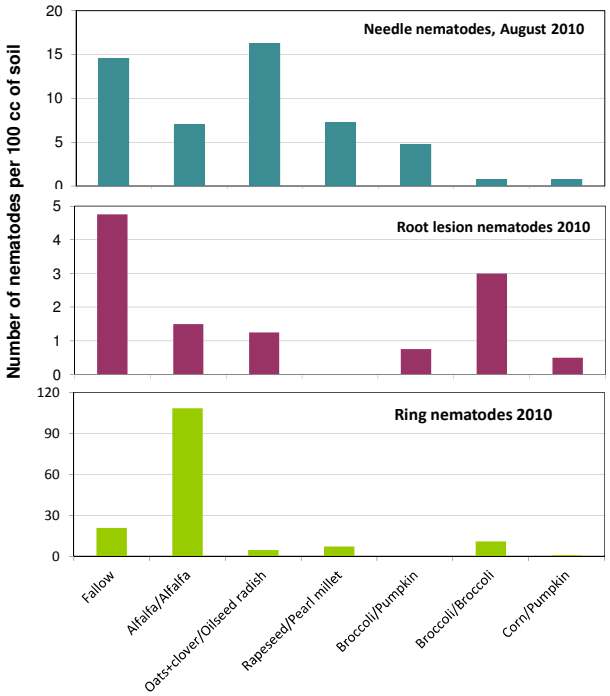

Figure 3. Nematode counts in the soil after the second year of crop rotations, which were started in 2009; Note the different scales of the y-axis.

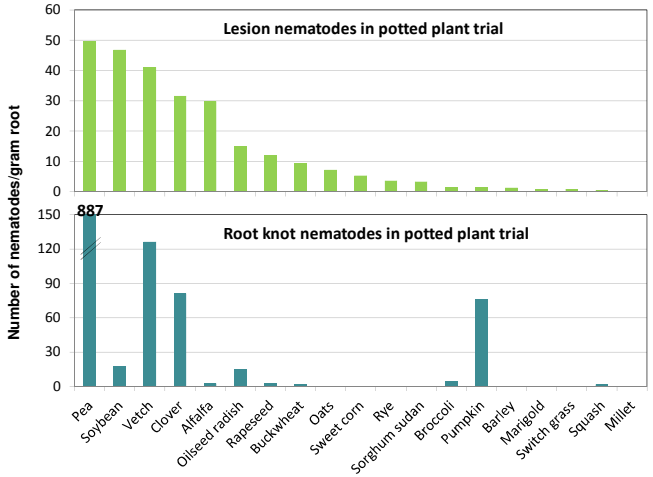

Figure 4. Effects of different rotation crops in a potted plant trial on the number of root lesion and root knot nematodes after 60-90 days.

Results and Discussion

In the field trial, nematode numbers were reduced after 3 years of crop rotations and fallowing, except for continuous alfalfa. Overall, nematode numbers were lower in 2011 than in 2010, which may have been due to the warm dry summer and/or cumulative effects of the crop rotations. Ring nematodes were the most numerous, particularly in alfalfa. The potted plant trials also showed that legumes supported more root lesion and northern root knot nematodes than the other rotation crops. Pea was an especially good host for northern root knot nematode. This suggests that legumes, despite their desirability as nitrogen-fixing crops, may not be the best choice when planted right before strawberries, although they may be useful earlier on. Tarping of broccoli residues may improve nematode control by trapping biofumigant gases.

Conclusion

Rotation crops can reduce plant-parasitic nematode populations in soil and also provide organic matter and cash income. The most promising cover crops in our study were sweet corn, pumpkin, and broccoli. Pumpkin is probably best earlier in the rotation due to its moderate susceptibility to northern root knot nematode, e.g, pumpkin/broccoli/sweet corn. Further studies are needed to assess nematode suppression by different cultivars of these crops.

Acknowledgements

We thank MSU Project GREEEN, the Michigan State Horticultural Society, and NASGA, for financial support and the Delange family for generously hosting the trial on their farm.