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Science for Environment Policy

Resistant sugar beet varieties better for controlling cyst nematodes than trap crops or pesticides

Growing sugar beet varieties which are resistant to their pest, the cyst nematode, is the best way to achieve high sugar yields in northern Germany, recent research has concluded. The researchers say this method is better than growing trap crops or using pesticides to control the pests.

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Source: Hauer, M., Koch, H.-J., Krüssel, S., Mittler, S. & Märländer B. (2016) Integrated control of *Heterodera schachtii* Schmidt in Central Europe by trap crop cultivation, sugar beet variety choice and nematicide application. *Applied Soil Ecology.* 99: 62–69. DOI:10.1016/j.apsoil.2015.11.017

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The EU is the world's largest producer of sugar beet, with the crop being grown in many Member States. The soil-dwelling microscopic roundworm, the sugar beet cyst nematode (*Heterodera schachtii*), is a widespread sugar beet pest. It attacks the plant roots, causing stunted growth, and may substantially reduce crop quality and yields.

It is crucial to control the pest, as high soil nematode populations can make production of sugar beets uneconomical. Common management practices include: growing nematode-resistant trap crops, such as oil radish or mustard — these plants attract the pest but inhibit its development and reproduction, which reduces the pest population; growing resistant or tolerant sugar beet varieties (resistant varieties are minimally affected by the pest, tolerant varieties are affected but able to withstand more damage than susceptible varieties); and applying a nematicide (pesticide) before sowing the sugar beet.

This study investigated the effect of different trap crops, sugar beet varieties and the use of a nematicide test product on nematode pest populations in sugar beet fields in northern Germany. Registered nematicides are currently not available for sugar beet in Germany.

The experiments were carried out at four field sites over two years, 2012–2013 and 2013–2014. At each site, the researchers grew two types of trap crops on a plot of land: one trap crop was a nematode-resistant mustard (*Sinapis alba*), and the other a crop mixture (consisting of *Trifolium alexandrinum* (clover), *Lupinus angustifolius* (lupin), *Pisum sativum* (pea), *Phacelia tanacetifolia* (purple tansy), *Guizotia abyssinica* (niger), *Avena strigosa* (bristle oat) and *Vicia sativa* (vetch)). Straw mulch without a trap crop was used as a control. The trap crops were planted in July or August, immediately after winter wheat (*Triticum aestivum*) or winter barley (*Hordeum vulgare*) had been harvested.

After harvesting the trap crops, three sugar beet varieties, one susceptible, one tolerant and one resistant to the nematode pest, were sown in March or April on sub-divisions of the main plots. Half of these sub-sub-plots were sprayed with a nematicide, containing the active ingredient Abamectin, before planting the sugar beet. The other half were not treated, as a control. The experimental design meant all combinations of trap crops, sugar beet varieties and nematicide treatments on the soil nematode populations could be tested.

The researchers counted eggs, juveniles and 'cysts' (egg-filled dead females) in soil samples to measure the initial and final nematode populations before and after trap-crop planting, and before the three varieties of sugar beet had been sown and after they had been harvested. In addition, the researchers took trap crop samples to measure above-ground biomass, and sugar beet root samples to measure the sucrose content and calculate the sugar yield.

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The study found that the most effective method for decreasing the nematode soil population was growing a resistant sugar beet variety, which caused reductions of up to 70% to occur. Growing susceptible and tolerant varieties increased the pest population, suggesting that even tolerant varieties would not be suitable controls for the pest.

Neither type of trap crop significantly suppressed nematode populations compared with the straw mulch control, except in one plot where a mustard trap crop had been grown in 2013–2014 and the nematode population was reduced by 40%. In this case, the mustard crop was sufficiently well established to provide adequate rooting density, as indicated by a high biomass of 3.3 tonnes per hectare (t/ha) (dry mass) compared with the dry yields of 1.1–2.5 t/ha in all other plots. Especially in northern Germany, establishing an adequate mustard trap crop is challenging, because many factors, including unfavourable weather conditions and late harvest of the previous crop, can negatively affect trap crop growth.

The study also found that the use of the nematicide did not significantly affect the nematode population or sugar yields. In addition, trap crops did not significantly affect sugar yields, but the variety of sugar beet grown and the initial nematode populations did. Sugar yields of all varieties declined with increasing soil pest densities established before sowing. Resistant and tolerant varieties, though, had similar sugar yields, which were higher than yields of the susceptible variety.

As a result of their experiments, the researchers recommend growing resistant sugar beet varieties as the most effective way to reduce nematode damage to crops and achieve high sugar yields.