COVER CROPS FOR DISEASE SUPPRESSION

By Janet Wallace

Cover crops can suppress parasitic nematodes and soilborne diseases, including apple replant disease, Fusarium wilt, Verticillium and other fungal diseases.

Cover crops can suppress soilborne diseases and pests in the following ways:[1]

1. Extend the length of a crop rotation. Increasing the time between susceptible crops can reduce the build-up of pathogens and pests. Most soilborne diseases can only survive a few years without a host. However, for others, such as brassica clubroot, it may take seven years without a cole crop or related weeds to eliminate the pathogen from the soil.*

2. Improve soil structure. "Soilborne diseases are most damaging when soil conditions are poor as a result of inadequate drainage, poor soil structure, low organic matter, low soil fertility, and high soil compaction."[2] By improving soil structure and reducing compaction, cover crops can help plants resist soilborne diseases. Sorghum-Sudangrass, sweetclover and oilseed radish are particularly good at loosening compacted soil.

3. Provide a physical barrier. A living or dead mulch of a cover crop can reduce the amount of soil (and pathogens) splashed onto plants. The mulch can also keep fruit, such as squash or tomatoes, off the ground. This works well when crops are planted into the dead mulch of a fall-planted cover crop.

4. Enhance suppressive effects of soil life. Cover crops affect soil life. The effect, however, is highly variable, differing between locations, and between years. At least two mechanisms are at work.

i) Cover crops stimulate microorganisms that suppress soilborne diseases. For example, a green manure of peas, Sudangrass, rapeseed, oats or rye was found to reduce Verticillium wilt in subsequent potato crops.[3] It appears that after cover cropping, the potato roots were colonized by more non-harmful fungi which may have displaced pathogens. Likewise, certain wheat varieties provide habitat for bacteria that suppress the pathogens responsible for apple replant disease.[4]

ii) Cover crops produce substances that suppress pathogens or parasitic nematodes. For example, the decomposition of brassicas releases glucosinolates that can inhibit nematodes and pathogens. Indian and brown mustard (*B. juncea*) have very high levels of glucosinolates; whereas canola has lower levels.

Forge and Cutlass mustard cultivars have been shown to have a strong effect on soilborne patho-

* A list of plant diseases and the number of years they survive in the soil can be found on pgs. 124–137 of ***Crop Rotation on Organic Farms*** (free download at www.sare.org/content/download/60067/808447/file/Crop%20Rotations.pdf).

Examples of disease suppression by cover crops

- Tomatoes planted in a dead mulch of hairy vetch had higher yields, lived longer and had less foliar disease than tomatoes planted in a black poly mulch. The effect was not simply the result of nitrogen provided by the vetch.[1]
- A dead mulch of hairy vetch reduced rates of fusarium wilt in watermelon by 26%.[1]
- Rapeseed, wheat and rye suppressed root rot in beans.[2]
- Brassicas suppressed take-all in wheat, Sclerotinia (white mould) in lettuce and Verticillium wilt in cauliflower.[6]
- Indiangrass (bunchgrass) and brown mustard led to approximately 30% higher strawberry yields compared to yields from strawberries in fumigated soil.[9]

gens, while oilseed radish shows a moderate effect, and canola has a minimal effect.[2] A Maine potato study found that brassica cover crops suppressed scab, black scurf and other soilborne diseases.[5] Some diseases were best suppressed by the cover crops with high levels of glucosinoates; the reverse was true for others. However, brassicas are hosts for nematodes; nematode populations may rise while brassicas are growing but later be suppressed by the decomposing residue.[6]

Incorporating green manures

The way a cover crop is incorporated is critical. Working with the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), Anne Verhallen and Janice LeBoeuf examined the effect of mustard cover crops on root lesion nematodes. Verhallen recommends:

1) mowing the green manure and chopping it into small pieces;

2) tilling or discing immediately afterwards, possibly making more than one pass; and

3) light packing and/or irrigating to intensify the biofumigant effect.[7]

When using cover crops to help suppress disease, care must be taken to avoid harming crop growth by hosting pests or diseases, or tying up nitrogen. In B.C., Dr. Tom Forge looked at the link between cover crops and populations of the root lesion nematodes implicated in apple replant disease. He concluded that oats and rye did not appear to support the populations of the nematodes, unlike many weeds and cover crops (particularly brassicas and legumes).[8] Other studies found that hairy vetch suppressed black root rot in vegetables, but was a host for a lesion nematode, and white clover led to more root rot in beans.[2]

Oats and Sudangrass have been found to suppress root rot in corn, but not increase crop yields.[1] It appears that decomposition of the carbon-rich cover crop residue immobilized nitrogen. The benefit of less root rot was offset by slower growth due to lower levels of nitrogen.

The take-home message? With the right choice and management, a cover crop may help suppress soilborne pests and pathogens. And if not, a cover crop can provide other benefits, protecting soil from erosion, reducing nutrient leaching, controlling weeds and improving soil quality.

Photo credit: Anne Verhallen, OMAFRA – A cover crop of mustard blankets the field in yellow.

References:

1. Stone, A. 2012. Cover crops for disease suppression. eXtension Foundation webinar.

2. Abawi, GS & TL Widmer. 2000. Impact of soil health management practices on soilborne pathogens, nematodes and root diseases of vegetable crops. *Appl. Soil Ecol.* 15:37–47.

3. Davis, JR et al. 2010. Ecological relationships of Verticillium wilt suppression of potato by green manures. *Am. J. Potato Res.* 87(4):315–326.

4. Mazzola, M & K Mullinix. 2005. Comparative field efficacy of management strategies containing *Brassica napus* seed meal or green manure for the control of apple replant disease. *Plant Disease.* 89(11):1207–1213.

5 Larkin, P & TS Griffin. 2007. Control of soilborne diseases of potato using Brassica green manure. *Crop Prot.* 26:1067–1077.

6. Hartz, TK, PR Johnstone, EM Miyao & RM Davis. 2005. Mustard cover crops are ineffective in suppressing soilborne disease or improving processing tomato yield. *HortSci.* 40(7):2016–2019.

7. Verhallen, A. 2010. Assessment of biofumigant cover crops for the reduction of nematode and verticillium pressure in processing tomato breeding plots, Year 2 assessments. OMAFRA.

8. Forge, TA, RE Ingham, D Kaufman & JN Pinkerton. 2000. Population growth of *Pratylenchus penetrans* on winter cover crops grown in the Pacific Northwest. *J Nematol.* 32(1):42–51.

9. Seigies, AT & M Pritts. 2006. Cover crop rotations alter soil microbiology and reduce replant disorders in strawberry. *HortSci.* 41(5):1303–1308.