Soybean Root Nematode

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ABSTRACT

The article It is particularly damaging to soybean and can be a chronic pest if not managed properly. This factsheet reviews how to identify root-knot nematode on soybean, explain its lifecycle, and go over management options.

Keywords: Soybean leaf, insects, eggs, White fly, Bihar hairy caterpillar.

Root knot nematode of soybean is caused by plant parasitic nematodes belonging to the genus Meloidogyne. Several species are known to infect soybean including. Root knot nematode, as the name implies, attacks the roots of soybean. Affected root systems contain irregular, large growths, called galls. Galls can be distinguished from beneficial nitrogen fixing bacterial nodules by breaking open the structure; galls will be colorless to milky white inside, whereas nodules will be pink. Galls are also generally much larger than nodules. Severely affected root systems are often swollen, knotty, and irregular in shape (Figure 1). Plants affected by RKN may become chlorotic and/or stunted due to reduced access to water and in severe cases plant death may occur.

Lifecycle RKN overwinters in the soil as eggs. Root exudates from a susceptible host (i.e. soybean) will trigger RKN juveniles to hatch if soil temperature exceeds 50°F. Once hatched, the juveniles seek susceptible host tissue and a suitable entry point, usually at the root tip just behind the root cap. After the nematode penetrates the root, it establishes a feeding site (gall) and becomes sedentary. Females eventually lay eggs in a gelatinous matrix outside of the root, which may hatch and infect more roots as long as soil temperatures remain conducive, or may lay dormant for years until proper host and environmental conditions are satisfied males play little to no role in reproduction. The timespan from egg to an adult, egglaying female can be as short as 21-28 days depending on soil temperature.

As an obligate parasite, root knot nematodes require a living plant to reproduce. The root knot nematode life cycle will occur more rapidly when temperatures are above 64°F and host plants are available. Sandy soil texture with large spaces between particles also promotes more movement through the soil since root knot nematodes move through water films.

The life cycle of root knot nematodes is typically between 21-25 days; however, reproduction can occur as fast as 14 days under optimal conditions. The juvenile nematodes first molt occurs within the egg and emerges as a second stage juvenile (J2), the infectious stage for root knot nematodes. The J2 is attracted by root exudates and penetrates the root near the tip (at the area of cell elongation). The juvenile then becomes sedentary and secretes chemicals that create giant cells that create the appearance of galling. Juveniles become adult nematodes after three more molts within the roots. Male nematodes will leave the roots while the balloon-shaped female remains feeding on the giant cells and laying eggs into an egg sac. Under favorable conditions juveniles will hatch immediately from eggs, otherwise they will remain dormant. Eggs can survive in soil for several years until favorable conditions for hatching arise.

Rotating soybeans with small grains can help prevent the buildup of root-knot eggs in the soil. Most all major agronomic and vegetable crops grown in Delaware are susceptible to root-knot (see table 1); however, there are resistant and/or tolerant varieties of some crops (check seed company for more information). Rotate with M. incognita resistant or tolerant varieties in infested fields whenever possible.

Plant soybean varieties that have good resistance or tolerance to root-knot nematode. The southern root-knot nematode is the major root-knot nematode species affecting soybeans grown in the southern United States, therefore many of the resistant varieties are group V soybeans and up, but there are some resistant group III and IV varieties. Consult your seed company for varietal resistance ratings.

Cover crops and biofumigation can be used as part of an integrated approach for managing root-knot nematode. Planting and incorporating a biofumigant-type mustard with high glucosinolate production can potentially fumigate root-knot nematode eggs in the soil and reduce root-knot damage on a subsequent crop. Mustard varieties can be sown in early spring or fall (if the variety has good overwintering properties). Mustards should be flail chopped two weeks prior to full bloom for maximum biofumigation potential and immediately incorporated into the soil using a disk or chisel within 20 minutes of chopping. Ideally, approximately ½ inch of water should follow incorporation, which is necessary to seal the soil surface and synthesize the biofumigant gasses. If done correctly, studies have shown that biofumigant mustards can significantly reduce root-knot populations [2]. It should be noted that some mustard species are hosts for M. incognita, so root-knot populations could actually increase if the biofumigation crop fails or is not properly incorporated.

There are a bevy of seed treatments marketed at reducing nematodes, including RKN. These products may have some utility in fields with low populations of RKN, but will not be effective in heavily infested fields. In addition, the effects of seed treatments are short lived, and therefore only act to protect the plant in the very early stages of development.

References:

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