

Nematodes that Economically Impact Cotton in Texas

Root-knot nematode: These nematodes get their name because of the galls that form on roots (Fig. 1). The galls cannot be removed from the roots and diminish the ability of the roots to uptake water and nutrients from the soil. One affect of root-knot nematode is that the plants require more water to get the same amount of growth as a plant that does not have root-knot nematode. In a water-limited environment it may be impossible to supply the plant with enough water to produce high yields. Root-knot nematode starts out as an egg and hatches as a second-stage juvenile. This small vermiform shaped nematode can move between soil pores in a thin film of moisture and infect roots. Once in the root, it goes through several more molts until it becomes an adult. The female does not need a male to fertilize it, but can produce eggs that are genetically identical to the female. Females are very large compared with second-stage juveniles and cannot move out of the root. A single female can produce hundreds of eggs in a sack attached to its body. The time it takes to complete a life cycle depends on the temperature. Warmer temperatures mean faster reproduction. It is possible to have a generation produced every month. The majority of the population is in eggs, of which a portion hatch into second-stage juveniles after they have sufficient heat units to mature and moisture. Dry conditions inhibit hatch.

Reniform nematode: The adult stage of this nematode looks reniform shaped. This nematode has a number of stages before becoming an adult where it can move through the soil or roots. However, once becoming an adult, the nematode is “stuck” in one location. This nematode also has the ability to produce many eggs in a sack, however, the female must be fertilized by a male to allow reproduction. This nematode can also complete its lifecycle in a month, or even less if it is warm enough. It is capable of building up to very high levels in the soil. Reniform nematode has been devastating to cotton fields in the Southern High Plains. In a typically dry summer, plants infested with reniform nematode often are only 1-2 feet high, and yield at 200 to 600 lbs of lint/acre in irrigated fields (Fig. 2). There is no diagnostic symptom associated with the reniform nematode.

Population Distribution Maps: Root-knot nematode is capable of causing economic damage in sandy soils. It is rare to find it in heavy textured soils, and usually does not cause damage in the heavier soils. Reniform nematode is more flexible in the soil texture where it occurs. It is capable of causing significant stunting in both sandy and fine textured soils. In the Southern High Plains of Texas, root-knot nematode is a significant problem in Gaines, Dawson, Terry, Yoakum, Lamb and Hockley counties. In these counties, it is commonly found in areas where the soil is sandy. In counties like Cochran, Lynn, Lubbock, and Crosby, it is also capable of causing damage, but a smaller proportion of the county has sandy soil. The reniform nematode is most common in Lynn county, but has been found in many other counties in the Southern High Plains including Lubbock, Hockley, and Terry counties. While root-knot nematode is found in approximately 40% of irrigated cotton fields in the Southern High Plains, reniform nematode is found in < 1% of irrigated cotton fields.

Management of Nematodes in Cotton:

- A) *Chemical control:* The options include seed treatments like Avicta complete pack (Syngenta) and Aeris (Bayer CropScience). The most common product applied over

the last 30 years is Temik 15G (Bayer CropScience) at rates ranging from 3.5 to 6 lbs/acre. Most years and sites, we find a 5 to 10% increase in yield with Temik 15G in root-knot nematode fields. Other options that can be included with Temik 15G include N-Hibit (Plant Health Care, Inc.) on the seed + Temik 15G at planting; and Temik 15G at planting + Vydate CLV (Dupont) applied at 17 oz/acre at pinhead size square. Fumigants can be applied before planting that are effective at killing nematodes. Telone II (Dow Agrosciences) at 3-5 gal/acre is the most common fumigant recommended. This product is difficult to obtain in Texas and a contact person to order product is: Kevin Basham, Hendrix & Dail, 800-872-0644.

- B) *Resistant cultivars:* There are no cultivars with high levels of resistance to root-knot nematode. Deltapine 174RF (Monsanto) does have some resistance to this nematode and often yields well in its presence. Stoneville 5458B2RF (Bayer CropScience) does not have resistance to root-knot nematode, but does appear to tolerate the nematode, and typically yields very well in its presence. There are no cultivars with any resistance or tolerance to the reniform nematode.
- C) *Crop rotation with root-knot nematode:* Most crops grown in the Southern High Plains are hosts of the southern root-knot nematode, which is the species (*Meloidogyne incognita*) that attacks cotton. Peanuts however, are not a host of this nematode, so one year of peanuts is sufficient to reduce the nematode population density by approximately 90%. Cover crops (wheats, oat, rye) are hosts of this nematode, so planting a cover crop after peanuts, particularly in a warm winter, may result in some buildup and reduce some of the benefits of rotating with peanut. Sorghum is a host of root-knot nematode, but in several cases where research has been conducted, cotton has excellent yield following sorghum in the presence of root-knot nematode.
- D) *Crop rotation with reniform nematode:* Corn and sorghum are not hosts of the reniform nematode and make excellent rotation crops. One of the best ways to manage the reniform nematode is to get in an every other year rotation with a monocot like sorghum. Two years out of cotton are not necessarily more beneficial than just a one year rotation.
- E) *Other factors:* One of the best ways to manage root-knot nematode is to get off to a fast start. It is important to manage blowing sand with a cover crop, seedling disease, thrips, and early season water stress. If the cotton can establish a good root system then it can tolerate a certain amount of root-knot nematode pressure. However, if the plant gets off to a slow start and the nematode to a fast start, then it is difficult for the root system to ever outgrow the nematode pressure. The worse case is when the nematode destroys the taproot. From that point on, water stress will be a major problem, and it is not possible to irrigate enough through the damaged lateral roots. A field with significant tap root damage should receive no further inputs.

Sampling for nematodes: Soil sampling should be conducted when the nematode populations are high, which occurs from midJuly through September. Root-knot

nematode is very difficult to sample accurately during the winter months. Reniform nematode is easier to sample for year round. A soil sample should be a composite of 20 cores that are taken in an area of the field. A ¼ mile pivot (120 acres) should have four composite samples taken. Take the core from the bed if possible, about 6 to 12 inch depth. Mix the soil in a bucket, then place about 1 quart of soil in a plastic bag. Do not use a paper bag since the soil will dry out. The sample must be kept out of the sun or extreme cold. Even 10 min. in the sun in 50-degree weather will cause enough overheating to kill nematodes in the sample. Root-knot nematode is killed at temperatures even close to freezing.



Figure 1. Galls caused by root-knot nematode.



Figure 2. Stunting caused by reniform nematode in an irrigated field.