Rohwer, Arkansas, on an Hebert silt loam (fine-silty, mixed, thermic Aeric Ochraqualfs) soil. This test, the McConnell - Mitchell Plots, is the oldest continuous test in Arkansas. The irrigation method reported is furrow flow (FI) and was compared to a dry land (DL) control. Nitrogen treatments reported within each block are 0-, 60-, and 120 lb N/acre. Nitrogen treatments were first applied in 1982 and continued through1999; discontinued from 2000 through 2003; then resumed in 2004. Soil samples were taken in the early spring prior to N-fertilization from depths of 0 to 6 inches and 6 to 12 inches. The samples from three replicates of each N-treatment from both blocks were analyzed for pH. The calcium, sodium and bicarbonate content of the irrigation water at the test site had the potential to drive the soil pH up. Fertilization with ammoniacal nitrogen sources has the potential to reduce soil pH. Soil pH was monitored over the duration of the experiment to determine the irrigation and N-fertilization treatment effects on soil acidity.

Initially, in 1982, the soil pH of the test site was uniform with an average pH of 5.8 in both the 0 to 6 inch and 6 to 12 inch depth. As the study progressed differences in soil pH were observed as a consequence of both N-fertilization and irrigation. Soil samples taken in the spring of 1985 showed increases in pH in the FI block, ranging from 6.3 to 6.7. No change in pH was observed in the DL block. N-fertilization apparently negated some of the irrigation effect in the FI block. The pH of soil treated with 120 lb N/acre was approximately 6.0, while the pH of the unfertilized plots was approximately 6.9. No significant effect was observed in the DL due to N-fertilization. Trends similar to 1985 were observed when the 1990 samples were analyzed. The elevated pH observed in the FI block during 1985 remained higher in 1990 than values initially observed in 1982. The soil pH of DL block was further reduced from 1985, ranging from 5.3 to 5.4. The greatest N-treatment, 120 lb N/acre, produced the lowest soil pH, 4.8. Changes in soil pH in 1995 and 2000 were similar to those observed in 1990. Samples taken from the DL block indicated the soil was continuing to acidify, particularly when N-fertilization rates were high. Samples taken from the FI block indicate that irrigation was preventing rapid soil acidification. Soil pH in the FI block was greater than the DL both in 1995 and in 2000. The soil pH of the FI block trended lower with increasing N-rate in 1995 and 2000. The lowest pH was observed in this study occurred in 2000 in DL soil treated with 120 lb N/acre. This soil pH, 4.2, was substantially lower than the initial, background pH found eighteen years earlier.

Fertilizer N-treatments were discontinued for the 2000 through 2003 growing seasons to further examine the changes on soil properties and plant growth characteristics of cotton. Irrigation treatments were continued all years throughout the 2000 to 2003 growing seasons. Prior to resuming N-fertilizer applications in 2004, soils were sampled and analyzed. These samples indicate a slight increase in soil pH in the DL block compared to 2000. Soil samples taken from the FI block indicated a reasonably stable pH compared to 2000 and 1995, although suspending the 120 lb N/acre treatment may have resulted in a slightly higher pH.

Management Strategies Against Southern Root-Knot And Reniform Nematodes In Cotton

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Nematodes continue to be one of the major pest problems that cause major losses each year to cotton. The two most important nematodes in the mid-South include the Southern root-knot and reniform nematodes. The root-knot nematode has been a problem since cotton was grown in this country but reniform has only developed into a major pest within the last 50 years. Losses can range from 5-10% in fields that show little if any symptoms to 40-50% losses in fields that are severely damaged by these nematodes. Damage from these two nematodes depends on populations present at the time of planting and soil factors such as texture, nutrient status, hardpans, and profile. Areas of a field that are very sandy at both the surface and down to a depth of several feet are usually at the highest risk for nematode injury even with fairly low populations of nematodes. Areas of a field that have finer-textured soils (usually with more clay) or have these soils near the surface are not nearly at as much risk and may support fairly large populations of nematodes without as appreciable damage.

Management strategies should include practices that will reduce the populations of these two nematodes to low enough levels that they will not cause damage. The two methods that are currently most widely used include the use of crop rotation and nematicides. All of the various crops that are grown in the mid-South impact these two nematodes. Ideally, crops should be selected that will reduce populations of the pest nematode to lessen the damage potential for cotton in the future. Crops such as corn, peanut, grain sorghum, rice, sugarcane, and wheat are very poor hosts for reniform nematode. Even one year in one of these crops can reduce reniform populations by 60-70%. Unfortunately, reniform populations build up to such high levels in some of our fields that even a 70% reduction is not sufficient to bring the levels down to where they cannot still cause serious injury to cotton. In cases such as this, a second year in a poor host crop may be required just to get the levels to decline to at least a more acceptable number. Because wheat is grown during the winter months, it seems to have very little impact on reniform populations and shouldn't be considered a good rotation crop for this pest. The list of poor hosts for the Southern root-knot nematode is much smaller. Peanut, soybeans (resistant varieties), and grain sorghum are about the only crops that seem to fairly poor hosts for this nematode. Most of the rice is grown in soils that are not very conducive for root-knot or where the nematode doesn't survive very well during the flooded conditions of our summers. One of our favorite rotational crops is corn which works well against reniform nematode but rather poorly against root-knot. One of our test fields was extensively sampled (32 samples) after three years of cotton and then one year of corn. The average population of root-knot nematode was 1511 per 500 cm3 of soil after three years of cotton and had only declined to 900 per 500 cm3 of soil after one year of corn. In fields which have both nematodes present, crop rotations may shift population dynamics in favor of one nematode over the other.

The second method of reducing nematode populations involves the use of nematicides. Nematicides may either directly kill nematodes or impact the nematodes ability to parasitize cotton roots. In both cases, the goal is to allow the plant sufficient time to establish a good root system before the nematode population either resurges or regains the ability to begin successfully feeding on the roots. Most of the time if the roots are protected long enough, very little damage will show up on the plants. Unfortunately, if high populations do build up and stressful conditions occur late in the growing season (usually drought), a fairly substantial level of damage can occur. The use of seed treatment nematicides has become very popular in the mid-South. However, these nematicides are intended for fields or areas of fields which have low-maybe moderate levels of nematodes. Areas of a field which are at high risk from nematode injury (primarily deep sands) may be poor candidates for seed treatments alone. In these cases, supplementing with either a fumigant or a side-dress application of another nematicide (Temik 15G) may be required. Since these materials can be costly, treating only the areas where these chemicals can cause an economic response are advised. Management zones can easily be created in fields where different nematicides or rates can be applied within a field. These management zones can be created from a number of different sources including soil texture, crop yield, growth patterns, or soil sampling.

The use of the Veris 3100 Soil EC Mapping System has proven to be a useful tool in defining soil texture in the mid-South. Not only can it be used to define texture near the surface but down to 3 feet. Soil texture can be extremely variable in some of our delta soils within the same field. Even in fields which don't appear to have much variability in texture, hardpans or even subtle differences in sand size can be distinguished. Cotton yield monitors are becoming more available on newer equipment. Yield monitors can show very clearly where cotton yields are poor. Although these areas are not always nematode related since they can be heavy soil, wet spots, chemical damage, or other causes, they are certainly easily checked out to find out if nematodes are the culprit. A third method of developing management zones includes using plant growth during the growing season. Aerial imagery can be obtained from airplanes, satellites, or tractor mounted systems such as GreenSeeker which gives a measurement of plant development during the growing season. Weaker growing areas in a field can easily be identified using these tools and can be related back to nematode injury. Ground-truthing is always required with aerial imagery since you can get a false impression of plant growth by only looking at a map. Soil sampling still remains one of the best ways to identify nematode types and population levels. I personally favor zone sampling where you collect soil samples from similar soil texture or areas within a field. In large fields, you may even have to divide the field up into several samples even from within similar soil texture. Grid sampling can at least give you some idea of where nematodes are located within a field but has limited usefulness unless the field lacks textural variability. Combining all these tools together can really help you identify where in a field the nematode risk is high, medium, or low. You can then use the correct nematicide or nematicides or even rates depending on the risk zone.

The third management option that is perhaps the least used includes the use of resistant or perhaps tolerant varieties. Resistant varieties would limit the amount of reproduction by the nematode and result in lower populations of the nematode at the end of the growing season. Ideally, the variety would yield well and not require treatment with a nematicide. None of the commercial varieties that are grown in the mid-South have strong resistance against either the root-knot or reniform nematode. STN 5599BR has moderate levels of resistance against root-knot but still may require treatment with a nematicide when populations are very high. Tolerance to either root-knot or reniform nematode implies that the plants will do well even in the presence of the nematodes. There is evidence that a few varieties show fairly good tolerance to reniform, but they still may not yield as well as other susceptible varieties that have been treated with a nematicide. Tolerance in a cotton variety usually doesn't decrease nematode populations and can leave high levels for the next year.

Nematode management requires careful attention to detail. You need to know where the problems occur in a field, what the populations are doing, and what will be the best approach to reduce them. Modern tools allow us to do much more than the blanket application of a nematicide like we did in the past. Additionally, we have a lot more problems with reniform nematode than we did even 15-20 years ago. Although we are never likely to get rid of these nematode problems, we can at least limit the amount of damage they cause.

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