Alfalfa Root Health and Disease Management: A Foundation for Maximizing Production Potential and Stand Life

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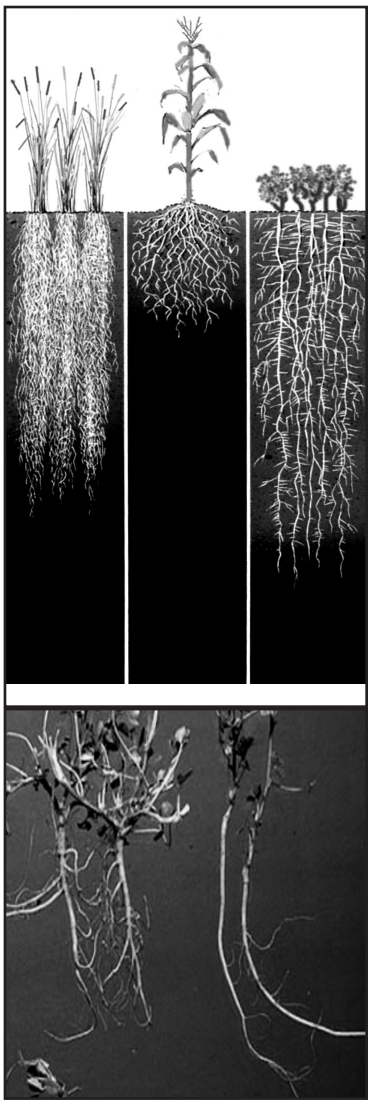
Beneath the lush green leaves of an alfalfa plant is a surprisingly large root system. Alfalfa roots grow about 6 feet per year in loose soil. Metabolically active alfalfa roots have been found 60 feet or more below ground level. It is this large root system that is at the heart of the valuable traits of the crop. The ability of alfalfa roots to form an association with soil bacteria (*Sinorhizobium meliloti*) and "fix" atmospheric nitrogen into compounds that satisfy the nitrogen needs of the alfalfa crop, as well as the nitrogen needs of the following rotation crop, is well known. The ability to fix nitrogen also enables the plant to provide highly nutritional protein-rich forage. The deep root system allows alfalfa plants to access soil moisture that is not available to annual crops with shallow root systems, making alfalfa more drought-tolerant. Another function of alfalfa roots is to store carbohydrates produced in leaves so that plants can regrow rapidly after harvest and green-up in early spring. As an added advantage, the extensive root system and early spring growth of alfalfa reduces soil and nutrient loss from nearby bare soil. Thus, a healthy alfalfa root system is key to maximizing yields, forage quality, and stand life.

Many factors influence root growth and root health of alfalfa, but diseases can be especially important. Several different diseases infect the roots of alfalfa, but among those, two emerging diseases in the upper Midwest are more damaging and widespread than was thought at one time.



Symptoms of Aphanomyces root rot (right)

Aphanomyces Root Rot

Alfalfa cultivars with resistance to two highly destructive root diseases found throughout the Midwestern U.S., Aphanomyces root rot and Phytophthora root rot, have been available for many years. Although they are usually thought of as seedling diseases, both diseases can also attack roots of adult alfalfa plants. These diseases are most common in wet or poorly-drained soils. In the past few years, reports of problems caused by Aphanomyces root rot have become more common. At least two different races of the Aphanomyces pathogen are known that attack alfalfa; however, most alfalfa cultivars with Aphanomyces resistance only have resistance to race 1. A 2001 publication reported results of a survey for race 1 and race 2 in 13 fields in Wisconsin, seven fields in Minnesota and one field from Kentucky. Aphanomyces was found in 16 of the 21 fields. In the majority of fields, both races 1 and 2 were found. Surprisingly, both races were found in fields that had not been planted with alfalfa for at least 30 years. This suggests that the pathogen can persist in soil for long periods of time or that other plants aid in its survival. Currently, a larger survey is being conducted to determine the frequency of race 2 isolates in Wisconsin and southeastern Minnesota. Nearly half of the 300 soil samples that will be surveyed from alfalfa-producing counties in Wisconsin and Minnesota have been collected. Currently, testing and data analysis has been completed on 85 samples. Preliminary results are showing a predominance of Aphanomyces race 2. Of the 85 tested samples, 48 have tested positive for Aphanomyces race 2, with only 11 samples positive for Aphanomyces race 1. Sample collection and testing will likely continue through the 2008 growing season.

Symptoms and Management. The common symptoms of Aphanomyces root rot in alfalfa seedlings are stunted plants with yellow to purple discoloration and small, tan-colored root systems with few nodules. The symptoms of Aphanomyces root rot in adult plants is the absence of fine fibrous roots and most lateral roots, and few nodules. The plants appear stunted, do not regrow well after cutting and the foliage is often yellow. A soil test is available through the University of Wisconsin Plant Disease Diagnostic Clinic to determine which race is present. The test involves growing alfalfa seedlings with resistance to the different races in soil from sampled fields. Because it is still unclear how races develop, it is advisable to plant an alfalfa cultivar with resistance to race 2 only after determining that race 2 is actually present in your soil. Instructions for submitting soil samples for testing are available at: http://pddc.wisc.edu/submission.html

Brown Root Rot of Alfalfa

In 2003, brown root rot of alfalfa was reported for the first time in Wisconsin and Minnesota. It is likely that the fungus causing this disease has been present for many years but was not recognized. A three-year survey showed that the pathogen is present across Minnesota and Wisconsin, and may be more common in the Red River Valley, St. Croix River Valley and west of Green Bay. The fungus is slow growing and prefers cool soil temperatures (less than 60°F) for growth.

Symptoms and Management. Symptoms of the disease may not be visible until after the third winter because of the slow growth of the fungus and its dependence on environmental conditions for symptoms to develop. Because the fungus rots alfalfa roots during fall and spring, it can severely weaken plants and contribute to winter kill. Symptoms of the disease are stunted and dead plants in 2- to 3-year-old fields with brown sunken lesions on taproots. Infected plants may start to regrow in spring and then stop growing and die in late spring to early summer because the tap root has rotted off. The fungus also causes disease on other perennial forage legumes and winter wheat. Research shows that its inoculum increases using corn and soybean plant debris, but how this contributes to the disease is not yet known. Currently, no resistant varieties are available, although trials are in progress to determine if current cultivars have resistance to the disease. A free test is available to determine if plants are infected with the pathogen or if the pathogen is present in soil. Details for submitting samples are available at: http://www.tc.umn.edu/~medicago/brr.htm

Drought & Alfalfa Nutrition

by Michael Russelle, USDA-ARS Plant Science Research Unit - St. Paul

Although established alfalfa can access deep subsoil water, dry topsoils limit the availability of many nutrients.

For example, boron is absorbed to soil clays and organic matter, and its release is governed by soil pH, the composition of the soil solution, and wetting and drying cycles. When topsoils are dry, both boron availability and uptake are limited.

But dry topsoils can also limit the uptake of other nutrients, including phosphorus, potassium, sulfur, and molybdenum. How should you react to a potentially dry 2007 growing season?

The answer depends a lot on your specific field conditions. If your soil tests are in the optimum to high range or if you have applied manure to the field in the past few years, it is unlikely that the current crop will respond to additional nutrients.

However, if the soil tends to be droughty, is shallow, or has low fertility, you might want to consider topdressing alfalfa after the first harvest with commercial fertilizer or manure. Base the application rate on soil tests taken early this spring and follow your state regulations for manure application.

With either source, apply as soon as possible after harvest, but only on firm soil to reduce damage from wheel traffic. Neither source will provide significant nutrients to the alfalfa if the topsoil remains dry, so the decision to fertilize should be made with an eye to the weather forecast.

The water content of manure slurry can improve regrowth, but broadcast slurry can coat the leaves with solids that prevent photosynthesis and suffocate the tissue. When broadcasting slurry on alfalfa, apply no more than 1.5 tons of solids/acre.

An important caveat: Manure from a herd with diseases like Johnnes should not be used on alfalfa that will be stored as hay, because the organisms persist on the soil and plant surfaces and could infect healthy livestock.