

A SOLUTION TO SOME SPRING-SEEDED ALFALFA PROBLEMS

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One of the most important assignments I received when I assumed this position in 1990 was to address the question, "What is the cause of seeding failure when alfalfa is spring-seeded into soils that remain wet after seeding?" Six years of laboratory and field work have finally borne fruit. Based on our research, we can confidently present Kentucky alfalfa producers with three conclusions and a recommendation.

CONCLUSIONS

1. *Aphanomyces* root rot is the cause of a common seedling disease syndrome when alfalfa is spring-seeded into soils that are generally wet for 4-6 weeks after seeding.
2. Alfalfa varieties with an R or HR resistance rating to *Aphanomyces* root rot can *sometimes* provide improved seedling health and alfalfa hay yields when *Aphanomyces* outbreaks occur.
3. Unfortunately, the levels of *Aphanomyces* resistance available in current alfalfa cultivars are inadequate for *consistent* control under severe disease pressure.

Recommendation: When spring seeding alfalfa, use only varieties with an R ("resistant") or HR ("highly resistant") resistance rating to *Aphanomyces* root rot.

SYMPTOMS OF APHANOMYCES ROOT ROT

Emergence of alfalfa seedlings out of the soil is normal. The most striking symptom of the disease is stunting, often severe stunting. The plants don't topple over, like they would in a case of *Pythium* damping off. They simply stop growing well after the seed leaves (cotyledons) unfold. The cotyledons remain small; they often turn yellow, sometimes red, and may eventually wilt and turn brown.

The true leaves--the unifoliolate and the trifoliolates that follow--are usually quite small. The leaflets are small, and the petiole (the stalk that holds them to the stem) is also small. These leaves have a bluish-green cast instead of a normal lush green color. The bluish-green color is the same color seen in established alfalfa under drought stress. The internodes--the stem sections between sites where petioles are attached--are unusually short. This gives the plant a very compact, stunted appearance. If one examines the roots, they will have a light brown color, and sometimes be rotted away. Although this is a wordy description, this syndrome is very recognizable in the field. Refer to this description when investigating problems relating to spring seedings.

OCCURRENCE

Soil types. The fungus, *Aphanomyces euteiches*, is present in about two-thirds of the alfalfa fields sampled in Kentucky. I can find no pattern relative to previous cropping history, herbicide use, etc. It appears that *A. euteiches* simply is present in some soils and absent from others. Our research indicates that the fungus can die out when introduced into a soil where it is not already present. We don't know why *A. euteiches* fails to survive in some soils, although there are several possible explanations. Nevertheless, *A. euteiches* is common in Kentucky soils, so we recommend that producers simply assume it is present in each field to be seeded to alfalfa. Soils with a textural class of silty clay loam or heavier are heavy enough to allow the disease to develop, if the fungus is present and extended wet weather occurs after seeding. The disease sometimes occurs in silty loams, as well.

Weather conditions. If "wet-soil conditions" prevail for four to six weeks after seeding, *Aphanomyces* root rot often develops. I say "wet soil conditions" and not "rainfall", since many of these heavier soils remain wet for several days after a springtime soaking. Although *Aphanomyces* root rot can occur in a late-summer seeding, spring seedings are much more commonly affected. Why spring seedings? One reason is that rainfall amounts in Kentucky are often higher in April and May than at other time of the year. The other reason is that soils tend to remain wet after rainfall during the spring as compared to late summer, because of cooler soil temperatures and more overcast conditions.

Distribution in field. If the disease develops, it usually occurs throughout the field, not just in the low areas, although it may be slightly more severe in the low areas of a field. Sometimes one can find a thin strip of healthy plants along a back furrow where the soil drainage is much better than the field itself. I also have seen several instances where thin strips of healthy plants occurred right along the edge of a field.

Cultural practices. Some of our evidence suggests that the disease is worse in a no-till seeding, probably because the soil doesn't dry out as quickly as in a plowed field. However, severe outbreaks of *Aphanomyces* root rot can develop in a conventional tillage field as well, if disease pressure is high enough. As I mentioned above, I can find no pattern of disease occurrence relative to previous cropping history, herbicide use, etc. If the fungus is present in your soil, and your field experiences 4-6 weeks of wet soil conditions after seeding, there is a potential for *Aphanomyces* root rot to develop. There is no better guideline than that.

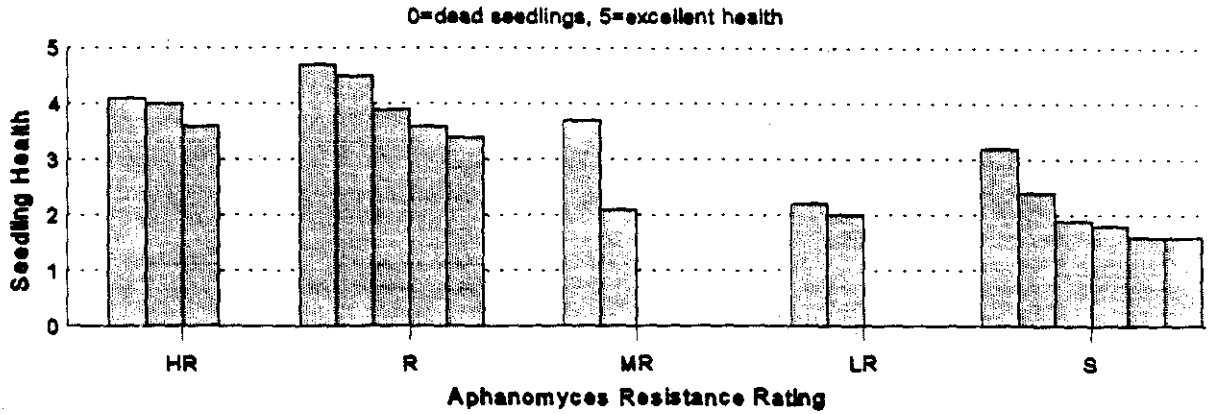
HOW DO APHANOMYCES-RESISTANT VARIETIES PERFORM?

This is a case of good news/bad news.

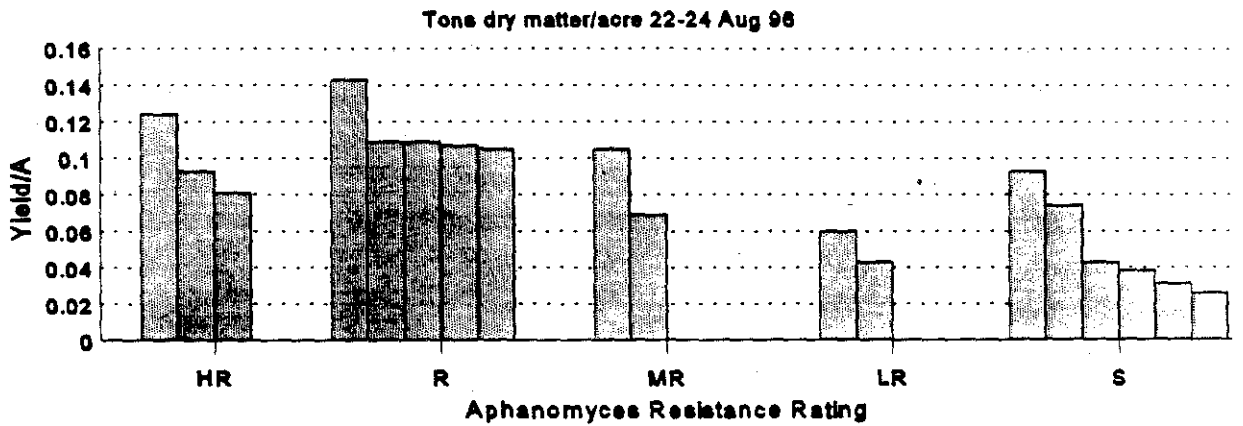
The good news. We do see improved seedling health and alfalfa hay yields that correlate to the level of *Aphanomyces* resistance for most cultivars. The following two figures provide data from the Eden Shale Research Farm, where a severe outbreak of *Aphanomyces* root rot occurred

in 1996. The field test had alfalfa varieties that ranged from susceptible to highly resistant² for Aphanomyces root rot.

Alfalfa Seedling Health



Alfalfa Yield



²These resistance ratings indicate the percentage of plants in that variety that are resistant to Aphanomyces root rot in a standardized test, as follows.

Susceptible (S): Less than 5% of plants are resistant.

Low resistance (LR): 6-15% resistant plants.

Moderate resistance (MR): 16-30% resistant plants.

Resistance (R): 31-50% resistant plants.

Highly resistant (HR): over 50% resistant plants.

A couple of other observations are worth noting. First, note the variation that occurs among the varieties within each resistance rating. For example, just because two variety have an MR rating, they don't respond the same to the disease in the field. The resistance rating are a useful guideline, but they are not an absolute predictor of performance in the field. Second, with one exception, only varieties with an R or HR rating had yields statistically equal to the highest-yielding cultivar (complete analysis not presented here).

The bad news. Unfortunately, the levels of *Aphanomyces* resistance available in current alfalfa cultivars are inadequate for *consistent* control. Our evidence for this is quite solid, with a good statistical basis in replicated plots. However, perhaps the most convincing evidence of this is the fact that I have seen severe cases of *Aphanomyces* root rot in commercial fields seeded to varieties with an HR rating to *Aphanomyces*. That's as high a level of resistance as a grower can get. We are collaborating with several alfalfa pathologists in Wisconsin to sort this out, but for now, think of it this way: high disease pressure can overwhelm even the best *Aphanomyces* resistance currently available.

MANAGEMENT RECOMMENDATIONS

Based on six years of research and diagnostic experience, the University of Kentucky College of Agriculture is now recommending using alfalfa varieties with resistance to *Aphanomyces* root rot when seeding in the spring. Based on our research thus far, I would use only varieties with an R or HR rating to the disease, although even an MR resistance rating would be preferable to using a susceptible variety. Using *Aphanomyces*-resistant varieties is probably particularly important in no-till seedings.

The fungus *A. euteiches* is very common in Kentucky soils, and our weather conditions during spring often allow the disease to develop. If I were seeding alfalfa during the spring, I wouldn't take a chance on this problem. Producers have enough risks without assuming risks that they can reduce. Using an *Aphanomyces*-resistant variety is not a guarantee of a disease-free stand. As I said above, severe outbreaks of *Aphanomyces* root rot can occur in a highly resistant variety. It's unfortunate, but it's a reminder of how powerful Mother Nature is. Nevertheless, we now know that high levels of *Aphanomyces* resistance can sometimes be the difference between getting the stand established and losing it. By seeding an *Aphanomyces*-resistant variety, growers can improve their chances of successfully establishing alfalfa in the spring.

COLLABORATORS

This *Aphanomyces* root rot work has been a multidisciplinary project since Day One. Important contributors along the way include: Dr. Jimmy Henning and Leonard Lauriault (UK Dept. of Agronomy), Dr. Bill Nesmith and Jack Doney (UK Dept. of Plant Pathology), and Don Sorrell, Kim Strohmeier, David Hull, Tim Hendrick, Beth Prewitt, and Gary Carter (UK Extension Agents), and Eugene Patrick (producer).