MATCHING ALFALFA PLANT SYMPTOMS WITH ALFALFA PROBLEMS

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Abstract: Alfalfa is very diverse genetically, which means that there are resistant and susceptible plants in the same population. Field diagnosis of production problems by using plant symptoms is not a fool-proof system for exact identification of problems, but when used by an experienced observer, symptoms can be valuable in selecting the possible answer. Plant symptoms also can be confusing because several problems may create the same kind of plant symptom. Observers are encouraged to consult reliable guides and to confirm with diagnostic tests to avoid mistaken diagnoses. A quiz has been prepared to test the observer's knowledge of plant symptoms to indicate alfalfa problems.

Keywords: Alfalfa, Symptoms, Pest, Diagnosis.

Alfalfa is a very diverse and genetically heterogenous crop, with resistance to many pests (insects, diseases and nematodes), and containing a great deal of diversity in terms of morphological characteristics such as winter dormancy, size of stems, leafiness, etc. Most alfalfa varieties are composed of a variety of genetic sources. For example CUF 101, contains 91 different clones, or individual plants, randomly crossed to produce the breeder's seed. These individual plants come from the following germplasm sources: UC Cargo (55%); UC Salton (1%); UC 76 (22%), 1972 breeding mixture (20%); and Niagara N71 Brand (2%). Some varieties have as many as 1000 individual plants in their makeup.

GENETIC DIVERSITY PROVIDES RESISTANCE

Our present system of developing varieties provides such diversity that it has been stated by prominent alfalfa geneticists, that there is no alfalfa insect or pest problem that cannot be solved by developing genetic resistance if enough time and money can be combined with a team of innovative scientists. This diversity also means that pest resistance is not measured in terms of absolute immunity such as rust in wheat, but it is measured in terms of percent resistant plants. For example, a variety classified as highly resistant (HR) to the blue alfalfa aphid (BAA) (Marble, 1988) need only have 51% or more seedling plants that survive a standard resistance test. That means there could be 49% or less susceptible seedlings that don't survive. The same situation goes for a variety classed as low resistance (LR), which signifies only 6 to 14% resistant plants.

Occasionally, even breeders have good luck! For example, Lahontan, developed jointly by the USDA, University of Nevada, and the University of California, proved to have resistance to the spotted alfalfa aphid (SAA) when that deadly pest struck just one year after Lahontan's release. Lahontan was not developed to combat the SAA, but was actually released as a bacterial wilt resistant, stem nematode resistant variety to add persistence in our alfalfa fields. So, again this diversity provided a huge benefit in terms of dollars, with no cost. Lahontan, being of so-called "Turkistan" origin, carried this resistance factor, which was not expressed until a pest came to the United States from the Old World.

FIELD DIAGNOSIS OF ALFALFA PROBLEMS

This diversity also affects symptoms that we frequently use to diagnose alfalfa problems in the field. Plant symptoms are only roughly able to provide an accurate diagnosis. Some are more valuable than others, but usually, symptoms are not as reliable as many people working in the field with diagnostic techniques would presume.

Varieties with HR for a particular disease, as explained above, have a number of plants with lower levels of resistance, even many plants that are susceptible. Thus, you might find plants not expressing a particular pest resistance in the same field, side-by-side with plants that do express resistance. The diversity and genetic heterogeneity of alfalfa make this possible.

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Some factors are symptomless, or very difficult to diagnosis because of a lack of a clear, easily observable change. Phosphorus deficiency is almost impossible to diagnose accurately through plant symptoms. There is just not enough difference between a phosphorus deficient plant and one that has sufficient phosphorus. Also, for example, there are symptoms associated with phosphorus deficiency that may be associated with drought stress, such as stunting caused by reduced stem elongation, and small, bluish-green leaves.

Another diagnostic dilemma occurs when comparing the long-established, widely occurring disease of Fusarium wilt (Fusarium oxysporum) with the newly discovered disease (in areas other than the San Joaquin Valley) of Verticillium wilt (Verticillium albo-atrum). Both have similar root symptoms of discolored, darkened vascular tissue, and crowns with some wilted stems. There are other more specific symptoms for Verticillium wilt, but it is difficult to make the diagnosis accurately unless a sample is submitted to a pathological diagnostic laboratory.

How would one diagnose root-knot nematode from plant symptoms? An experienced observer can "usually" determine whether or not there is a "likelihood" of root-knot nematodes by examining root samples and noting if there are roots with swollen areas on feeder roots coupled with many small roots going out from each of the swollen joints. However, this is very difficult to be accurate. Insect problems, of course, are less difficult since we can usually observe the actual causal agent. Still, misdiagnoses occur with insects as well as diseases and nematodes.

DIAGNOSTIC GUIDES AVAILABLE

Fortunately, there are very good alfalfa plant diagnostic symptoms published and available for study. Two of the best are the University of California IPM Alfalfa Manual (2) and the "Alfalfa Analyst" (3). There are other publications of considerable value (1,4,6).

THE QUIZ

I have wanted to do this "Quiz" for several years. I have hesitated because of the time commitment, the uniqueness of the idea, and the difficulty in putting the discussion together with appropriate slides and pictures, and the possible implication that one can visually diagnose most or all alfalfa problems. I don't believe that is the case, but with experience, one can certainly narrow the possibilities to a very few, which can then be resolved through more detailed tests. And in fact, some problems can be diagnosed very accurately just from visual symptoms. I hope you will see some of these in the examples that will be provided. I am sure you will find some that cannot.

What I am going to do is give a short quiz, with slides. You must identify the problem from these slides, then match your answer against the list of 26 "problems" provided in the proceedings. I have tried to make this "Quiz" as uncomplicated as possible. Probably it will need some redesigning if it is done another time by a more courageous individual! This will be a "self-test", not graded. So be honest!

Alfalfa is affected by many factors, but not all are significant. Producers and their advisers must sort out those symptoms that are significant. So, in this "test", another space is provided so you can indicate whether or not the disease, insect, etc. is a very significant (scored as a 10) production-affecting factor, or is it simply an academic problem that it may be "nice to know" (scored as a 1) but not important to be able to recognize or to know a solution for overcoming by variety choice, chemical treatment, or change in production practices, or perhaps a combination of all three.

I am going to use from one to several slides to try and set the scene to give you enough background information to make an intelligent judgment as to what a particular problem could be. Some may be difficult, others no doubt will be quite simple. Obviously, the slides will not be in the same order as the numbers with possible solutions in the proceedings! I will try and give enough time at each slide for you to sort through and make a decision. The list has been divided into 13 "disease" problems and 14 (numbers 13 to 27) insect, nematode, and nutrient deficiency problems. The number of examples will only be limited by the time alloted for this discussion!

In order for everyone to begin on the right foot, my first sequence will be that of root mealy bug damage, number 19. So you should mark number 1 in the sequence column after root mealy bug. The significance of root mealy bug is, in my opinion, about a number 4. I have given that significance ranking because the problem is not widespread, and the pest is

a slow-moving one, but when present it can seriously reduce yield. It is not solveable by varietal means, nor as far as I know, by chemical means. Management is the only possible solution, probably a crop rotation.

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	Sequence shown on screen	Significance[1]	Is it solveable by: Variety	Chemical	Management
"Disease" Problems:					
1. Phytophthora root rot					
2. Southern anthracnose					
3. Common leaf spot					
4. Stemphylium leaf spot					
5. Fusarium wilt					
6. Sclerotinia rot					
7. Stagonospora root rot					
8. Scald (low oxygen)					
9. Alfalfa mosaic virus					
10. Genetic chimera (marker)					
11. Herbicide damage to roots					
12. Herbicide damage to leaves					
13. Defoliant damage to leaves					
"Insect, Nematode, Deficiency" Problems:					
14. Green pea aphid					
15. Blue alfalfa aphid					
16. Potato leafhopper					
17. Thrips					
18. Clover root curculio					
19. Root mealy bug	1	4			
20. Armyworm					
21. Spider mites					
22. Root-knot nematodes					
23. Potassium deficiency					
24. Phosphorus deficiency					
25. Nitrogen deficiency					
26. Boron deficiency					
27. Sulfur deficiency					

[1]Scale of 1 to 10, = not significant