

## Cropland disease. The art in the science: demystifying plant diagnoses. (7 June, 2017)

The diagnostic lab has been a little quiet this spring. Whether that is because of the delayed spring, the drought in many areas of the state, the increased use of electronic communications for diagnoses, or effective education by d-lab staff (one can only hope!), I'm not sure. However, it does give me an opportunity to pontificate on a topic that can be troublesome to many people: you observe a plant is not growing correctly, how do you diagnose what the problem is? The answer lies a great deal in experience, and is often more art than science. However, there is a common theme of asking questions and observing patterns. These principles hold for all pests and all plants.

### Steps of diagnosis:

1. Observe a problem
2. Postulate (guess) what the cause is
3. Determine if the evidence fits your hypothesis (educated guess)
  - a. observe symptoms on the plant
  - b. observe patterns on the plant or in the field/landscape
  - c. find evidence of the causal agent
4. If the evidence fits the hypothesis, stop; if not, repeat steps 2-3.

Bit of advice: the *simplest* explanation is usually the correct one.

I am of course not the first person to pontificate on this topic. If you want a more complete covering of the topic (in English and Spanish!), please see the APS education center article by Riley et. al.

<https://www.apsnet.org/edcenter/intropp/topics/Pages/PlantDiseaseDiagnosis.aspx>

I thought I'd just go through some examples of recent text messages and samples I've received to try to illustrate what I look for, make some comments along the way, and hope these illustrations are helpful.

Yesterday, I received this text with the note 'We suspect thrips damage in these lentils, is this what it looks like?' So, my first reaction is 'no, that's not what thrips damage looks like.'



they had them handy, used publications to compare to photos, or googled pictures if they had enough cell signal. There may not be that many pictures of thrips damage on lentils on the internet, though. So what do you do? Send it to someone who might know. I'm no entomologist, but I've seen a lot of lentils and a lot of thrips damage on different crops (that's the *experienced* bit, but there's always something new!). Thrips damage is caused by the mouthparts of the thrips rasping on the plant tissue and creates a silvery-white flecking, and can sometimes cause spotting on the leaves when it is severe. If I hypothesize there is

thrips damage, what do I do? You guessed it, look for the causal agent, thrips! To do that, I would beat plants against white paper (or whatever I had handy), and look for the little black adults flying away,

with some greenish larval thrips (no wings) left crawling around. I could probably find them with a hand lens in the youngest tissue of the plant or near the flowers. If they're not there, that indicates thrips are not a likely cause; if they are there, they are a possible cause of the observed symptoms. In this case, the symptoms in the first picture did not fit the hypothesized cause.

The client then sent me picture #2 so I could see the whole plant – they were seeing white spotting on the lower leaves. They also sent me a closeup, picture #3. These were very helpful. From picture #2 I

Picture 2



Picture 3



could see the majority of the damage was on the lower leaves. That told me the timing and pattern of the damage – the damage occurred earlier and the plant was growing out of it, indicating the causal agent was no longer stressing the plant. Sometimes the clean new growth just indicates the plant is growing so fast the new tissue has escaped the damage but the stress/fungus will catch up, so the interpretation of this pattern can mean different things depending on the causal agent and situation.

From the pictures, I could see the symptoms they were concerned with much more clearly. The green veins and interveinal chlorosis fit iron deficiency for me, so I asked about the growing conditions, pattern in the field and root health. Cold temperatures this spring caused a lot of nutrient deficiencies due to slow root growth. If it stayed wet and cold, root rots might be moving in. However, the roots on these plants were healthy.

I also saw most of the necrosis was collected at the leaf tips. To me, this suggests spray injury or frost damage where the dew collects. Sometimes

fungi move in there too, but the color was more white than the tan/brown I usually get with fungi. The client indicated the most severely affected plants were in patches associated with low areas of the field and the field had not yet been sprayed with an herbicide. Some of those low areas in the field collect water, salts, and weird effects that can exacerbate the damage due to other stresses. A stressed plant gets sick faster than a healthier plant. The fact the field had not yet been sprayed eliminated herbicide injury as a possible cause, so we settled on **frost damage**.

A second good example came in this morning, picture below. The client indicated they were concerned



about the blotches, and the symptom was occurring on 100 acres of a 500 acre field, all on the lower leaves. I enquired about frost pattern and herbicide application, similar to the example above. The pattern was not associated with a low area of the field, but upon further questioning, bronate and starane were applied. Turns out, the grower sprayed 400A, then went and sprayed their barley before coming back to the last 100A of canola. The symptoms are consistent with contact herbicide damage, perhaps exacerbated by cold injury and a 'hotter' tank of herbicide. I'm no weed scientist but I

know bronate can cause some burn in some situations. For more details, I would ask my weed science colleagues. Problem solved!

Example #3 is one where I'm not as helpful due to the quality of the image and information supplied.



The client asked a pretty typical: 'what are your thoughts on this?' leaving me wondering what my thoughts were about what....but, there's some obvious chewing damage on the base of the stem on the left. They were also concerned about the spot on the leaf at the right, which was pretty blurry. I can't tell the shape of the lesion, the color, or if there is chlorosis or watersoaking associated with the lesion.

That would allow me to discriminate between fungal and bacterial leaf diseases of pea. The client will get me more pictures later. Evidence in the form of insects causing the chewing damage and, if possible, a sample send to the diagnostic lab for the leaf spot would be helpful in providing a definitive diagnosis.

I could go on and on and on with examples, but I hope these three from my text messages this morning and last night are helpful to you as you consider your own field diagnoses.

For CCAs, consultants or county agents who may be interested, Jessica Rupp and I are putting on a hands-on advanced plant disease diagnostics workshop in Bozeman July 10-11. We have just a few spots left. If you're interested contact me or Jessica and we can send an agenda and registration form. This is not intended as an introductory class, it is for experienced consultants and registration is limited so we can have lots of interaction among the participants. Doug Jardine, a plant pathologist from Kansas State University, will be joining us and we can learn a lot from him, too!

If you have any questions or concerns, as always feel free to contact your local, friendly extension specialists. Our campus and field faculty contact information are on the MSU Extension website at <http://msuextension.org/>. Jessica is @MTextPSPP and I am @MontanaCropDoc on Twitter, and the Schutter Diagnostic Lab has a Facebook page we also post relevant diagnostic information to, including Montana Ag Alerts and Montana Urban Alerts ([mtagalert.org](http://mtagalert.org); [mturbanaalert.org](http://mturbanaalert.org)).

As always, thanks to all of you who contact us and keep us informed about what is happening in the field!

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