Troubleshooting Field Crop Problems

Field crop problems ranging from stunted or abnormal plants to dead or dying plants can pose urgent and difficult questions with economic consequences for producers. This publication describes a systematic approach to help farmers and crop consultants determine the cause(s) of field crop problems. This process is sometimes called troubleshooting. For the novice, troubleshooting can be intimidating in the absence of a systematic plan. For those with experience, a systematic approach to troubleshooting can help prevent the bias of looking only for the familiar and thwarting the investigative process.

First, determine the variety and the age of the plant. An investigator should identify the plant variety so that a basis exists for defining its normal appearance. This information may come from personal knowledge of the plant and its characteristics, from consultation with experts or from published references. Many plants may appear abnormal to someone unfamiliar with the normal characteristics of the crop and variety. In addition, the variety should be noted because some are more resistant or susceptible to certain diseases, insects or herbicides.

Second, identify all symptoms affecting the leaves, stems, roots and fruit. When troubleshooting a field crop problem, an investigator should observe all parts of abnormal plants, including the leaves, stems, fruit and roots as well as the tissue inside roots and stems. Frequently, the point of injury to the plant is not where the symptoms appear. For example, leaves on one or several branches may be discolored and withered because of a canker on a lower branch (Figure 1). Nutritional deficiencies and injuries from herbicides may damage both roots and leaves (Figure 2).

Details of symptoms on individual plants are extremely useful in diagnosing causes of plant diseases. Each causal agent will produce specific symptoms. These symptoms vary within limits depending on the intensity of exposure, growth stage of the plant, and environmental conditions during and after exposure. Examine individual plants in detail and determine the location of symptoms on the plant. For example, are symptoms on old or young leaves, upper or lower stems, or only one side of the plant? Look for insects and insect feeding damage. Cut stems to check for vascular discoloration and insect feeding (Figure 3).

Figure 1. Stem canker on a soybean plant results in yellowing and wilt of leaves on the affected stems.

Figure 2. The corn plant on the right, injured by herbicide carryover, shows reduced aboveground and root growth. Compare to healthy plant at left.

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Figure 3. Symptoms of wilt and death may occur on plant parts above the site of insect feeding within a stem.

Figure 4. Soybean plants killed by Phytophthora root and stem rot may be found next to healthy plants.

Hold leaves up to the light to check for mosaic, other viral symptoms, or the presence of webbing and mites. Investigators should look for leaf abnormalities in color, size, shape and texture. Also, carefully dig up roots and examine them. Check for galls, rot, abnormal root color and feeder root condition, and assess root growth. While probing the soil, note soil compaction, soil structure, texture and organic matter, and the presence and depth of hardpans. Also take note of odors, insects, fertilizer placement and the depth of planting.

Third, estimate the percentage of plants damaged in the affected part of the field and the severity of damage. Do you observe damage on all plants in an area or only 10 percent? Symptoms of injury due to insects and disease may appear on every plant in an area, but not always (Figure 4). Symptoms of injury due to herbicides will usually appear on every plant in an area.

Fourth, determine the field distribution or pattern of the problem in the field. Look at the front part of the field and traverse the field diagonally and across the backside before returning to the starting point. Follow this pattern flexibly enough to permit inspection of atypical areas of a field. The ends of rows and turn rows are especially interesting and should always be carefully examined. Excesses of agricultural chemicals and fertilizers at row ends due to improper speed of application equipment can result in crop injury. Also inspect plants in fence rows and the crops in surrounding fields and determine what agricultural chemicals have recently been used in these fields.

Determine the distribution of the problem in the field as it relates to field characteristics and drainage patterns. Take notice of whether the problem is associated with certain rows or areas of lower or higher elevation. Crop problems due to insects may develop because of a plugged insecticide applicator on a planter. Crop problems may also be caused by soil texture changes in a field (Figure 5), soil compaction because of traffic, overlap of a spray boom (Figure 6) or mixed nozzle sizes on a spray boom, and spray drift from a nearby field.

Figure 5. Plants may be stunted in areas of a field where the soil is sandy.

The distribution of affected plants in a field can provide much information on the probable cause of the problem. For example, diseases caused by pathogens that live in the soil have a strong interaction with soil characteristics. Typically, these diseases are distributed in large, circular to irregular areas that may reflect soil type, drainage patterns, cropping history, herbicide use or topographic features.

Symptoms of nutritional deficiencies and herbicide injury generally appear all at one time, and usually the injury does not continue to spread either throughout the individual plant or onto unaffected plants. Often there is a clear demarcation between injured and healthy tissue on the plant. Depending on the causal agent, damage may be widespread and include different crops.

Fifth, evaluate whether other plant species (weeds) in the field share similar symptoms. Examine the weeds in the area where the crop is injured and in nearby fence rows. For example, diseases are usually host specific, and weeds in the area are normally not affected. Leaf spots caused by drifting droplets of a contact herbicide (for example, paraquat) are not host specific, and several plant species in the area may show similar leaf spotting. Symptoms caused by nutritional disorders are usually not host specific. For

Figure 6. Herbicide injury can result from an overlap in a spray pattern.

Figure 7. Both a crop and weeds may grow poorly in soils with low pH. Healthy cotton and morningglory plants are shown in upper left.

example, low-pH soils will cause stunting of most plants in the field, including crops as well as weeds (Figure 7).

Sixth, determine the history of the problem. Ask when the problem was first noticed and whether crop problems were observed in the same area during previous growing seasons. Other important issues include the following:

- Dates and rates of fertilizer application, pesticide and growth regulator applications, and omissions or additions to usual crop management programs
- Irrigation frequency, rate, timing and water quality
- Soil pH, soil texture and drainage, planting depth, cultivation, cropping history, earth moving or construction, and burial or disposal on the site
- Air temperature, humidity, wind, lightning, clouds and air quality before and during symptom development
- Rate of symptom development coincident with any treatment or environmental event
- Recent human, animal, insect or mite activity around or on symptomatic plants
- Herbicides and rates used the previous year

Needed equipment

The following items will be useful when diagnosing field crop problems:

- Trowel or shovel
- Plastic bags for plant samples
- Knife
- Notepad and pencil or pen
- Magnifying lens (five to 15 times magnification)
- Camera
- Ice chest
- Sweep net
- Vials
- Field manuals

Troubleshooting a crop problem

As an example of how to resolve a somewhat complex plant problem, consider a soybean field in which all the plants in one corner exhibit tip dieback and marginal leaf scorch. The affected plants appear to have developed the syndrome at about the same time. A review of the grower's management practices indicates there had been a fertilizer application a week before symptoms developed. The environmental conditions after the application included a small amount of rainfall followed by dry, sunny weather. The affected corner of the field is characterized by higher elevation and a drier soil type than the rest of the field. A predisposing factor is the soybean variety's sensitivity to soluble salts (fertilizer).

You determine that the problem is due to fertilizer burn from excess soluble salts in the soil. You reach this conclusion by assembling in a systematic way the following pieces of information:

- Pattern of injury on individual plants — tip dieback and marginal scorch
- Pattern in crop — one field corner only
- Time frame for symptom development — all at one time
- Management practice — fertilization
- Environmental events — slight rain followed by dry weather
- Soil factors — drier soil in one area of the field
- Predisposing plant factors — salt sensitivity of soybean variety

The grower could confirm this presumptive diagnosis with a soil test for total soluble salts.

See the summary on page 4 for a list of steps to take when troubleshooting crop problems.

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Summary of troubleshooting crop problems

1. Determine the variety and the age of the plants, including stages of development.
2. Identify all symptoms on the leaves, stems, roots and fruit, and inside the stem and root.
3. Estimate the percentage of plants damaged in the affected part of the field.
4. Determine the field distribution or pattern of the problem in the field.
5. Evaluate whether weeds in the field (and margins) share similar symptoms.
6. Determine the history of the problem, which often provides the foundation for accurate diagnosis (or at least elimination of certain causes).

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