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Guide to Field Crop Troubleshooting

John P. Beasley, Jr., Extension Peanut Agronomist
Glendon H. Harris, Extension Soil Scientist
and Steven M. Brown, former Extension Cotton Agronomist

Field crop troubleshooting and diagnostics involve identifying the cause(s) of abnormal crop growth, development and production. Successful troubleshooting requires careful observation, thorough investigation and access to a broad knowledge base, as well as a certain level of relational and communication skills. The primary goal of troubleshooting is to determine and correct the original problem and/or to prevent its recurrence.

This publication is intended to enhance the diagnostic skills of agriculturalists, primarily county agents, consultants and others who directly advise farmers. Rather than address specific symptomology for a given crop, this publication outlines general principles associated with problem solving.

Observation

The initial step in solving a field problem is to collect information related to the expressed abnormality. In other words, what are the visible and/or measurable symptoms? Answering these questions involves gathering specific information from individual plants, the overall field and possibly surrounding fields. Studying non-crop plants in the field and along its border may also provide meaningful clues. It is also helpful to know what has occurred in the field in previous seasons.

Some situations are fraught with tension and anxiety. Because these emotions can hinder or distort information exchange, data collection and field observations, make every effort to remain calm and congenial in interactions with involved persons.

In addition to a careful, detailed inspection of particular symptoms, you also need to step back for a view of the field as a whole to get the "big picture." Look closely, but also look broadly. What is the overall stand and vigor of the crop? Are affected plants concentrated in specific areas or scattered across the field? Do symptoms vary with different soil types across a field? Are there discernible patterns associated with tillage, planting, fertilization, pesticide application and field topography, or are there obvious soil variations? Comparing normal and abnormal plants sharpens the focus of the observer. Comparative observations often provide definitive clues as to the nature of a problem. The investigator should examine roots, stems, foliage and reproductive structures, if they are present, from both affected and healthy plants. Do not hesitate to look at a number of plants from across the field and do not overlook any plant part.

Many factors cannot become known other than by asking questions. Details of tillage, planting dates, seeding rates, cultivars, rotations, soil test nutrient levels, historical productivity, pesticide applications and other cropping practices require input from the producer. Ask! Ask! Ask!

Routinely collect soil samples for nutrient and pH analysis. Soil testing is a simple, inexpensive means of verifying fertility levels that may be related to reduced crop growth and productivity. Likewise, depending on the time of year, sampling for nematodes may offer important clues. Remember that samples for nematodes must be handled differently than those collected for fertility/pH analysis. Nematode samples must be

kept cool so the nematode population can be accurately determined. In some cases, plant tissue samples may also provide important supporting information. Records of previous soil tests and fertilizer applications complete the information on soil amendments.

If arthropods (insects, mites, etc.) or other animal pests are implicated, it may be possible to locate the organism itself or signs of its activity. The presence of an insect, for example, may be displayed by feeding damage, fecal material, immature stage (egg, pupae), etc. Animal feeding can often be confirmed by the presence of droppings.

If pesticides are the potential cause of abnormal growth, obtain as many particulars as possible. What was sprayed and when? How was it applied? At what rates? Were there any spray additives or tank mixtures? When did the injury appear? What were the weather conditions at the time of pesticide applications? Is there an obvious pattern of damage associated with an application? It may be important to determine pesticide applications from previous years or adjoining fields. Other factors could include sprayer calibration, past products used (in a sprayer), mixing errors, etc. Observations in the mixing/loading site can provide clues as to potential sources of problems. Keep in mind that nutrient deficiency or toxicity symptoms sometimes mimic pesticide injury.

Follow-up contacts may be helpful. Frequently, an investigator fails to ask about a particular practice, only to remember it later. Return visits provide an opportunity to explore particulars that were neglected early; likewise, a second or third visit or conversation may confirm or correct information gathered previously.

Sample collection is also important for communicating with others who cannot immediately visit the field. Include abnormal and normal plants. Package material to preserve its integrity for examination.

A digital camera is an excellent tool for recording and distributing images of problems. Digital technology multiplies the number of investigators who can quickly examine and address an issue.

Finally, do not overlook weather. Precipitation can vary considerably from field to field. Put together a chronology of weather and rainfall, noting stress periods and rainfall events. The University of Georgia College of Agricultural and Environmental Sciences maintains a network of more than 75 weather stations across the state. The stations in the Georgia Automated Environmental Monitoring Network, which can be accessed at www.georgiaweather.net, provide current and historical weather information and are an excellent reference tool.

From observations and inquiry, the investigator develops an exact, detailed description of individual plant symptoms. The more specific the description, the better. For example, "marginal firing of the leaves in the lower canopy" is better than "bottom leaves burned"; and "pruned, club-shaped root hairs in the upper 3 inches of soil" is better than "damaged roots."

The complexity of a problem governs the nature of an investigation. An experienced troubleshooter may immediately recognize a specific problem without an elaborate search. On the other hand, more obscure problems and those with weighty financial consequences require meticulous information collection and some documentation of details. Written notes are essential if the problem is subsequently discussed with others. Writing down observations also disciplines the investigator to think concretely and thoroughly. Moreover, as time passes, written notes prove to be far more accurate than mental recollection. In some cases, photographs may aid in documenting symptoms. Digital technology has made the capturing of visible images easy and economical. In certain situations, timely observation and sample collection are critical to the process of investigation; in others, a passage of time may allow the problem to become readily apparent.

Diagnosis

With the description of plant symptoms and an overall field history, the troubleshooter has the tools for diagnosis. Observation concentrates on the symptoms. Diagnosis determines the cause of those symptoms. Proper diagnosis matches the observed effects with a particular cause.

There is no substitute for knowledge and experience. Formal and informal training as well as practice improve the skills of the investigator. Classroom instruction, short-courses, seminars and field days provide educational opportunities for the willing learner. At least as beneficial as formal training is the on-site guidance of a wise, seasoned crop advisor or producer. Eagerness to learn is an invaluable asset for a troubleshooter. Avoid quick judgments. Take time to think through the collected information.

Numerous references are available for diagnosing field crop abnormalities. Pesticide labels provide important information regarding product use. Printed materials – textbooks, handbooks, identification guides, etc. – have pictorial examples of a wide range of factors associated with field crop problems. These materials can be found at Extension offices, farm supply dealers and libraries. They are also frequently available at producer-oriented trade shows and similar meetings. The Internet is increasingly valuable in the diagnosis of field problems, but be careful and thoughtful about applying information from distant geographic sites to local problems.

A qualified expert can also serve as a valuable resource via telephone or e-mail. A proficient troubleshooter can advise another investigator regarding what to look for in the field, what common problems are currently being observed in other locales, and provide guidance in the search and determination process. He can also aid in the investigation through study of digital images. Direct or indirect input from an expert can be the difference in successful diagnosis.

Laboratories play an important role in confirming soil fertility and pH status, pest identification, nematode assays and pesticide residues. Good results require proper sampling and handling techniques. Taking a soil and tissue sample from a "good" and "bad" area of a field should help to confirm or eliminate soil fertility as the issue.

Remember that nearly identical symptoms may result from very different causes. For example, leaf chlorosis in certain species may be caused by (1) salt injury from fertilizer application, (2) root pruning associated with mechanical tillage, or (3) injury from a photosynthetic0-inhibiting herbicide. Conversely, a specific growth-inhibiting factor may produce a variety of observed abnormalities.

Sometimes an investigator faces a problem he does not readily recognize, a situation that can occur even for the most experienced field person. It is better to admit, "I don't know," and seek input from others than to offer an incorrect diagnosis. In addition, if a determination is uncertain, let it be known. Beware of giving absolute judgments when conclusions are not entirely clear. There are occasional problems that remain a mystery even after exhaustive investigation, forcing the acknowledgment, "We're not sure what happened." As much as possible, make sure the diagnosis is scientifically and logically justifiable. You never know when conclusions might have to be defended.

Solution

Once cause and effect are properly established, corrective options can be explored. Obviously, the nature of the problem determines whether or not it can be resolved immediately or simply avoided in future growing seasons. Either way, farmers and others involved usually benefit from a discussion of production practices that influence the observed problem.

People Skills

Field crop troubleshooting involves more than observation and diagnosis of biological abnormalities. It also requires skill in dealing with people.

Some problems are trivial; others can have tremendous financial consequences. Realizing the potential implications of a situation and discerning the disposition of those involved alerts the investigator as to what he may face. Occasionally, involved persons are hostile and ready to dodge responsibility or assign blame. Usually, the greater the monetary stakes, the more agitated the participants.

Since some information cannot be gathered merely by observation, the investigator must be adept at asking questions and listening to the answers. There is no secret formula for questioning a farmer, commercial applicator, dealer, etc., but do not antagonize. Troubleshooting should not be combative – just seek the facts. Anything that contributes to a cooperative, genial tone of discussion encourages the flow of information.

The presence of people can sometimes hinder the process of observation. In the field, group discussion of unrelated subjects can be a distraction that prevents the investigator from thoroughly examining the particulars. Group dynamics may also prevent independent thinking in the initial stages of investigation. Do not feel compelled to stay with the group. Take the time to walk off by yourself to collect information and think.

After examining plant symptoms and consulting about production inputs, the troubleshooter is usually expected to offer an opinion as to the cause of the problem. Communicate your opinions with tact and diplomacy. Be honest, fair and considerate. Leave room for discussion. While the presence of a group may hinder

or even sway fact finding, sometimes group discussion can enhance the formation of a conclusion.

Sometimes a verdict is painful. If observation and discussion uncover obvious human error, it may be best to allow the responsible party to come to that realization independently. Many people find it difficult to admit error, particularly when their livelihood and reputation are at stake. Focusing on solutions (when they exist) may diffuse the difficulties associated with such a situation.

Solving field problems can be extremely rewarding. The combination of knowledge, experience, observation, inquiry and communication skills provides the basis for facing challenging situations and providing accurate diagnosis.

Learning for Life

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