

A man with dark hair, wearing a light-colored plaid shirt, is leaning over a field of green plants. He is holding a pair of tweezers and examining a small insect on a leaf. The background is a dense field of similar green plants. The text 'INTEGRATED PEST MANAGEMENT' is overlaid in large white letters across the center of the image.

INTEGRATED PEST MANAGEMENT

Integrated pest management (IPM) protects crops based on specific field information, using both preventative and curative tactics to manage pests. IPM places an emphasis on scouting and thorough recordkeeping.

Examine problem area

- Is the problem scattered randomly through the field or occurring in a pattern?
- Is the problem more prevalent at a field entrance or along a fence, field edge or waterway?
- Is the damage more severe in low areas or on exposed slopes?
- Does the pattern correspond to planting, spraying or other field activities?

Pattern of stunted and yellow plants caused by soybean cyst nematode



Non-random strip of symptoms in a field



Check individual plants for symptoms and signs

Compare damaged plants with healthy plants. Check the entire plant, including leaves, stems, roots and internal tissues, for feeding injury or disease symptoms. A small hand lens, a pocket knife and a shovel are valuable tools. A sweep net or drop cloth can be effective in estimating the populations of bean leaf beetles and some other insects on soybeans.

Check the prevalence and severity of the problem

Damage from diseases and most insects progresses with time. If most of a field is affected uniformly at the same time, the problem may not be a disease or insect.

Herbicide-injury development rate may vary, depending on the herbicide involved and environmental conditions.

Check plant species affected

Several insects and many diseases are specific to soybeans or closely related plants. Similar symptoms appearing on different crops or weeds in the same area may suggest a non-biological problem, such as environmental stress or herbicide injury.

Answer these questions when scouting weed problems associated with herbicide failure:

- Is there only one weed species that is not controlled or are there several different species present?
- Are some plants of a weed species not affected by a herbicide application, while other plants of the same species are controlled?
- Are uncontrolled plants of the same species all of similar size and growth stage?

Consider time of year

Some diseases, insects, and weeds appear at different, yet often predictable, times during the season. This helps narrow down possible diseases, insects and weeds that may be causing problems.

GATHERING INFORMATION

Consider recent weather

Environmental stresses may damage soybean plants directly or make them more susceptible to certain diseases, insects or herbicide injury.

Collect background information for the field, such as:

- Previous crops
- Previous insect, weed and disease problems
- Planting date, depth and seedbed conditions
- Variety information, including resistance to insects, diseases and herbicide tolerance
- Chemicals used on or near the crop, including herbicides, fertilizers, fungicides and insecticides; indicate when applied, how applied, rate of application and weather conditions during and following application
- Additives and adjuvants used on the crop
- Current soil-test information (e.g., soil fertility, pH)
- Soil moisture and compaction
- Topography of the field
- Recent weather events
- Adjacent crop and non-crop areas



PLANT AND INSECT DIAGNOSTIC CLINIC

Symptomatic soybean plants, weeds and insect samples can be sent for identification to:

ISU Plant and Insect Diagnostic Clinic

327 Bessey Hall, Ames, IA 50011

E-mail: pidc@iastate.edu

Web site: www.ent.iastate.edu/pidc/

Phone: 515-294-0581

Submitting plants

- Provide plenty of fresh material. When possible, send the entire plant, including roots and top growth.
- Include enough plant material to show a range of symptoms.
- Provide appropriate background information for the field (page 10).
- Include photos when possible.
- Wrap specimens in dry paper towels or clean newspaper. (Do *not* add moisture.)

Submitting insects

- Collect multiple (6-12) intact specimens of all available life stages, not just body parts.
- Include intact plant material showing typical damage, packed as described above.
- Place hard-bodied insects (e.g., beetles, grasshoppers) in plastic bags, pill bottles or vials.
- Place soft-bodied insects (e.g., caterpillars, aphids) in a vial with rubbing alcohol or hand sanitizer.
- Submit insect samples in a padded mailer or box.

MANAGEMENT OPTIONS

Management Options for Diseases

	Resistance	Seed quality*	Crop rotation	Tillage	Planting date	Harvest date	Weed control	Seed treatments	Foliar fungicides**
Alfalfa mosaic		x							
Anthracnose		x	x	x		x			x
Bacterial blight		x	x	x					
Bacterial pustule	x	x	x	x					
Bean pod mottle		x			x			x	
Brown stem rot	x		x	x					
Cercospora leaf blight	x	x	x	x					x
Charcoal rot		x	x						
Downy mildew	x	x	x	x					
Frogeye leaf spot	x	x	x	x					x
Fusarium					x			x	
Phyllosticta leaf spot			x	x					
Phytophthora root and stem rot	x			x	x			x	
Pod and stem blight		x	x	x		x			x
Powdery mildew	x				x				x
Pythium root rot				x	x			x	
Rhizoctonia root rot								x	
Septoria brown spot			x	x					x
Soybean cyst nematode	x		x					x	
Soybean mosaic		x			x				
Soybean rust									x
Stem canker	x	x	x	x				x	
Sudden death syndrome	x				x				
White mold	x	x	x	x	x		x		x

* Seed quality refers to planting healthy, non-infected seed.

** Disease thresholds have not been established as to when fungicide application is necessary.

MANAGEMENT OPTIONS

Management Options for Insects and Mites

	Resistance	Crop rotation	Tillage	Planting date	Weed control	Seed treatments	Foliar insecticides*
Bean leaf beetle				x	x	x	x
Blister beetle							x
Cutworm and armyworm					x		x
Decates stem borer		x	x		x		
Grasshopper			x	x			x
Garden fleahopper							
Grape colaspis		x					
Green cloverworm							x
Imported longhorned weevil		x			x		
Japanese beetle							x
Seedcorn maggot			x	x		x	
Soybean aphid	x			x			x
Soybean leaf miner							
Soybean looper							x
Stalk borer					x		
Stink bug							x
Thistle caterpillar					x		x
Twospotted spider mite					x		x
White grub				x	x		

* Foliar insecticides are most cost effective when applied after exceeding treatment thresholds.

FUNGICIDE DECISIONS

Many fungal diseases can be managed with resistant varieties, crop rotation, tillage and foliar fungicides. The decision to apply a fungicide to manage a disease should be based on either an increased risk of disease developing (i.e., soybean rust or white mold) or actual disease identification, developmental stage at which disease occurs and the current and forecasted weather.

Considerations before using a foliar fungicide

- Varieties vary in their susceptibility to fungal diseases.
- Cropping history and percent surface crop residue affect the risk of disease. Many pathogens survive in crop residue, which can be a source of inoculum.
- Development of many diseases is favored by humid or wet weather.
- Disease presence in early reproductive growth stages may result in greater yield loss than disease that occurs later during grain fill.
- Fungicides do not affect bacterial diseases such as bacterial leaf blight and bacterial pustule.
- Profitability of a fungicide application depends on the price of grain and the cost of application.

Fungicide seed treatments may be beneficial under the following conditions:

- Early planting in cold, wet soils
- Planting in reduced till and no-till fields
- Planting seed with low germination rate (less than 80 percent) or low seed vigor
- Planting at lower seeding populations – remember, a final plant population over 100,000 is needed to maximize yield.

HERBICIDE DECISIONS

Herbicide programs typically include soil-applied (e.g., preemergence) and postemergence products. Soil-applied herbicides control weeds as seeds germinate, reducing early season weed competition and protecting yield potential. They also provide residual activity and greater flexibility in timing of postemergence herbicides. Postemergence applications target weed species not controlled by soil applications. Some postemergence herbicides only control weeds emerged at the time of application. Others control emerged weeds and provide residual activity against later emerging weeds.

A well designed weed management plan involves field scouting and protects crops from weed competition, prevents weed populations from increasing over time, minimizes herbicide injury and delays or prevents selection of herbicide resistant weeds.

Factors to consider when selecting herbicides

- Weed escapes or problems the previous year
- Environmental conditions the previous year, including conditions favorable for herbicide carryover
- Herbicide tolerant crops used the previous year and planned for the current year
- Tillage plans for the current season
- Using herbicides with different sites of action to delay or prevent selection of herbicide resistant weeds
- Using timely herbicide applications that prevent early season weed competition and provide residual control for late-emerging weed species
- Crop rotation plans for the next year (carryover)
- Postemergence herbicide label restrictions based on crop and weed growth stage or height

HERBICIDE DECISIONS

Soil-applied herbicide application

Factors particularly important to consider for soil-applied products include soil type, environmental impacts such as leaching or runoff potential and possible interactions with insecticides or other herbicides. Rates should be based on soil type, target weeds and objectives of the application (full-season weed control versus setup for planned postemergence herbicide).

Postemergence herbicide application

Field scouting is particularly important when selecting postemergence herbicides. Fields should be scouted frequently following crop emergence to determine the need and appropriate timing of postemergence weed control. Weed species, density and growth rates are critical factors influencing how long weeds can compete with the crop before yields are reduced. Treat fields with heavy infestations as soon as possible after weeds emerge. The initial growth of weeds is relatively slow, but their growth rate increases rapidly as time progresses. Weeds as small as two inches tall can reduce crop yields if present at high densities. Crop yield loss per day increases due to increasing competition of larger weeds.



INSECTICIDE DECISIONS

Insects can often be managed with resistant varieties, crop rotation, planting dates, tillage, weed management and insecticides. Beneficial insects also play a role in regulating pest populations. The decision to use an insecticide depends on proper insect identification, understanding the pest's life cycle, crop stage and various environmental conditions.

Considerations before using an insecticide

- Most insecticides reduce beneficial insects populations and can cause secondary problems (e.g., soybean aphid or spider mite flares in hot, dry conditions).
- Preharvest intervals may limit insecticide choice later in the season.
- Proximity to residential areas, bee houses and organic/sensitive crops may limit insecticide choices and application timing.
- Scouts tend to overestimate percent defoliation and apply insecticides unnecessarily. Use the guide on page 18 to calibrate your defoliation estimations.
- Some insects are aggregated near field-edge borders (e.g., grasshoppers, Japanese beetle). Spot treatments may be more cost effective if damage is restricted to border rows.

Insecticide seed treatments may be beneficial under the following conditions:

- Planting early
- Persistent bean leaf beetle (see page 46) activity during emergence/establishment
- Planting seed with low germination rate or low seed vigor
- Planting food grade soybeans

DEFOLIATION ESTIMATES

