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PEST MANAGEMENT GUIDE for FIELD CROPS INSECTS: Soybean section

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Introduction Figure 1: How to read the insecticide tables in this bulletin – a made-up example!

Active ingredients (AI) are listed alphabetically. Insecticides are listed by Trade Name under each AI to allow for comparison or substitution of products.

See Table 1 to cross reference active ingredients x insecticide.

A letter under an insect indicates it is on the label
• The specific letter corresponds to use rates in column 2.

Compare PHIs between products

A few of the important statements on the label

Active ingredient Trade names	Labeled rate per acre	caterpillars	cutworm	grasshoppe	spider mite	stink bugs	Pre - harvest Interval (PHI) in days	Precautions and Remarks
abamectin Big-Ten SC	(a) 1.7 - 3.5 oz				a		28	• Apply when spider mites are first observed
bifenthrin Brutus Buckeye	(a) 3.5 - 5.0 oz (a) 7.0 - 10 oz	a	a	a		a	18	• Do not make applications less than 30 days apart
chlorantraniliprole O-Hi Advanced	(a) 14 oz (b) 20 oz	a		b			1	• Must be applied before insects reach damaging levels
cyhalothrin (lambda) Izzo AG Green-UP WDG Lansing LV Scarlet 4F Spartan Izzo Extra Spartan Maxx	(a) 3 oz (b) 6 oz (a) 1 oz (b) 2 oz	a	a	b		b	30	• Do not graze or harvest vines as forage or hay

An AI with one trade name with a single rate (a) for one pest, spider mite

An AI with two trade names, each with its own single rate (a) for multiple insects
- For example, for cutworm the rate per acre is 3.5-5.0 oz of Brutus and 7.0-10 oz of Buckeye

An AI with one trade name but different use rates, (a) and (b), for different pests
- For example, the rate per acre is (a) 14 oz for caterpillars and (b) 20 oz for grasshoppers

An AI with many trade names, grouped by use rates; products in a group are similar and interchangeable
- For example, for cutworm use (a) 3 oz of Izzo Ag or 1 oz of Izzo Extra. Use the higher rate (b) for hoppers
- If you can't find Izzo Extra, Spartan Maxx is a similar product

Management of Insect Pests of Soybean in Michigan and Ohio *Updated: December 2025*

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How to Use this Guide

This publication is set up as a series of stand-alone tables with information on insect biology, damage, management recommendations, and insecticides registered in Michigan and Ohio on **soybean**. Pesticide names and rates are current as of the date at the top of the page.

- ✓ **Table 1** shows the timing of common insect pests in the crop, from early to late season.

- ✓ **Table 2** is a checklist of damage symptoms from these insects to aid in field scouting.

- ✓ **Table 3** has information on the life cycle of each insect, plus a detailed description of its damage and the conditions that may lead to or favor infestations. A rating of pest status (and thus damage potential) is given based on experience in the state. Most insect pests are uncommon or do not increase to damaging levels in a typical year.

- ✓ **Table 4** has information on management of each pest. Most insects are kept in check by natural enemies (biological control) or by adverse environmental conditions. Some pest problems can be reduced by simply changing or avoiding certain agronomic practices. Table 4 also gives scouting and threshold recommendations. Note that these recommendations vary in quality. Key pests tend to have research-based scouting methods and thresholds. But many insects are not at damaging levels often enough to generate good information; sampling recommendations and thresholds for these species are based on observations, experience, or a best guess. This is noted in the table.

- ✓ Insecticides registered in Michigan and Ohio (except where noted) on the crop are listed in **Table 5** (at planting) and **Table 6** (foliar sprays). Active ingredients (AI) are listed alphabetically in column 1. All products with the same active ingredient are grouped together under each AI for easy comparison or substitution of one product for another. Label rates and pests are listed in columns 2 and 3. A letter under a pest indicates that a particular insect is on the label (i.e., the label claims control of that insect). The letter corresponds to an application rate in column 2. Some insecticides are applied at a single rate for all insects ('a'), while others vary ('a', 'b', 'c'). The final columns in the table list the preharvest interval (PHI) in days and notes on application - for example bee toxicity warnings, minimum recommended spray volumes, or other restrictions.

Table 1: Timing of damage from insect pests of soybean in Michigan and Ohio

- Pests are listed from early to late-season. Key species are highlighted in bold text.

Common name	Overwintering stage, location	May	June	July	August	Sept
white grubs	larvae (grubs), underground	root feeding by annual grubs				
		root feeding by June beetle grubs				
seedcorn maggot	pupae, in soil	larvae (maggot) damage germinating plants				
wireworm	larvae, in soil	larvae damage roots				
slugs & snails	both eggs and adults, in field	feeding on seedlings and lower leaves of bigger plants				
black cutworm	Southern USA, migrate north	larvae feed on leaves and also off cut plants				
bean leaf beetle	adults, woodlots & residue		chew small holes in leaves		chew holes in leaves & pods	
soybean aphid	eggs, on buckthorn trees		nymphs and adults pierce leaves, feed on plant sap and secrete honeydew			
silver spotted skipper	pupae		larvae feed on leaves & live in a distinctive shelter made of leaves folded or tied together			
leaf-defoliating caterpillars (multiple species)	beet armyworm, webworm, yellow woolly bear - pupae All others: Southern USA, migrate north		larvae feed on leaves (defoliation). Earworm and looper may also feed on pods. Timing depends on species. • As early as June: beet armyworm, green cloverworm, thistle caterpillar, webworm, woolly bear • Later, July - August: earworm, fall armyworm, soybean looper, velvetbean caterpillar			
grasshoppers (multiple species)	egg clusters, underground			nymphs, then adults, feed on leaves		
Japanese beetle adults	larvae (grubs), underground			adults skeletonize leaves, mainly along field edges		
spider mite	adult females, at base of hosts			multiple generations pierce plant cells		
soybean gall midge	pupae, on/in ground			maggots feed on lower stems. *To date, not found in MI or OH*		
thrips	depends on species			adults and nymphs 'punch' and suck plant cells		
stink bug	adults, in & around fields			adults and nymphs pierce pods & beans		

Table 2: Damage checklist to aid in scouting for insect pests of soybean in Michigan and Ohio

Plant part or timing Type of damage or injury	bean leaf beetle	black cutworm	caterpillars (various)	earworm	grasshoppers	green cloverworm	Japanese beetle	seedcorn maggot	silver-spotted skipper	slugs & snails	soybean aphid	soybean gall midge	soybean looper	spider mite	stink bug	thistle caterpillar	thrips	velvetbean caterpillar	webworm	white grubs	wireworm
Stand (emergence)																					
seeds fed-on								x		x										x	x
cotyledons fed on underground								x		x										x	
cotyledons fed on at emergence		x								x											
seedlings cut before emerging		x																		x	
plants cut at ground level		x																			
gaps in row / stand loss		x						x		x										x	x
Leaves																					
slimy or shiny trails										x											
outer leaf surface scraped (windowpane feeding)										x											
small round holes	x																				
skeletonizing							x			x			x								
irregular leaf feeding			x	x	x	x	x		x	x			x			x		x	x		
generalized leaf yellowing											x			x							
stippled - tiny yellow spots														x							
pale scarring along veins																	x				
silvering of leaves																	x				
leaves cupped, crinkled											x			x							

Plant part or timing Type of damage or injury	bean leaf beetle	black cutworm	caterpillars (various)	earworm	grasshoppers	green cloverworm	Japanese beetle	seedcorn maggot	silver-spotted skipper	slugs & snails	soybean aphid	soybean gall midge	soybean looper	spider mite	stink bug	thistle caterpillar	thrips	velvetbean caterpillar	webworm	white grubs	wireworm
Leaves, continued																					
sticky or sooty mold coating											x										
webbing														x		x			x		
leaf rolling									x							x					
leaf drop											x			x							
plant death												x		x							
Stems																					
discoloration at plant base												x									
brittle stems, lodging												x									
Roots																					
root hairs missing																				x	x
pruning of whole roots																				x	
Pods and beans																					
pods clipped off	x																	x			
pod surface-scarring	x																				
small holes chewed in pod	x																				
large holes chewed in pod				x	x								x					x			
beans chewed <u>in pod</u>				x	x								x					x			
discolored beans															x						
shriveled, aborted beans															x						
Other																					
virus transmission	x										x						x				

Table 3: Life cycle, damage, and pest status of insect pests of soybean in Michigan and Ohio

Terms to describe the pest status of each insect. Ratings apply to Michigan and Ohio.

- **Rare**: Unusual, typically goes unnoticed. May not even be present
- **Uncommon**: Usually present but well-below damaging levels. An outbreak once a generation.
- **Occasional**: Present in most fields, sometimes in high numbers. An outbreak once a decade.
- **Important**: Present in most fields, potentially increasing to damaging levels every season. A common target of scouting, management programs, or insecticide use.
- **Sporadic:** Damaging levels occur after favorable weather patterns (such as drought) or mass movement from south to north during the season
- **Localized**: Damaging levels occur in specific locations under specific agronomic conditions, for example in no-till production or in older stands.

Pest (abbreviation)	Life cycle and Number of generations	Description of Damage	Conditions which favor infestation or damage	Pest Status in MI & OH
bean leaf beetle (BLB)	Adults overwinter in wooded areas, leaf litter, & field margins. Beetles emerge in spring, moving into alfalfa and then into soy after first cutting, OR directly into early-planted soy. Eggs are laid on the ground around plants. Larvae feed underground on roots & nodules and pupate in soil. New (1st generation) adults feed on leaves and pods. Potential for a 2nd generation in southern Michigan and most of Ohio.	• Overwintering adults feed on younger plants, leaving small round holes • Later in the season, adults feed both on leaves and the surfaces of pods. Pod injury creates entry wounds for pathogens & results in shriveled or moldy beans • Adults may clip pods off • Adults can transmit bean pod mottle virus (BPMV) which can affect yield and discolor beans. BPMV contributes to 'stay green' syndrome	• Fields planted near alfalfa or planted very early are at risk for colonization by overwintering beetles • Late-planted fields avoid overwintering beetles, but can act as a trap crop and can have high late-season pod injury	Occasional BLB is a very common insect in soybean, but few fields go over threshold. Pod damage is typically more important than defoliation.
cutworm *including black and variegated cutworm*	Black cutworm moths migrate into Michigan and Ohio in early spring. Eggs are laid on low-growing weeds or residue. Small larvae feed on weeds but shift to the crop after herbicide is applied. Larvae hide during the day & feed at night. Pupation in soil. 1st generation most damaging	• Small larvae may chew holes in leaves • Larger larvae damage the stem at the soil line or cut seedlings off, reducing stand	• Low, dense weeds or weedy field edges (egg-laying sites) • No-till fields with high crop residue • Planting into cover crops or wet areas	Uncommon We have only seen BCW in soybean a few times.
grasshoppers *several species including red-legged & differential*	Eggs overwinter in soil. Nymphs emerge in June. Feeding increases as nymphs grow. Females deposit groups of eggs in the undisturbed soil in late summer. 1 generation per year	• Defoliation of plants by nymphs and adults; feeding has a ragged appearance • Hoppers may also chew into green pods and consume beans	• Undisturbed fallow areas, roadsides, & pasture are common egg-laying sites. Hoppers move into field edges from these areas • A dry summer & fall can lead to high numbers the following year	Uncommon Outbreaks rare
green cloverworm	GCW overwinters roughly south of a line from Ft Wayne IN – Findlay OH. It recolonizes the rest of our area in early spring. Eggs are laid on undersides of leaves and larvae feed on foliage. When disturbed, they flop around and wriggle violently. 2 generations per season	• Larvae defoliate plants, eating the leaf tissue between the veins. Plants can appear tattered	• Strong weather systems from the south may carry large numbers north in the spring.	Uncommon Outbreaks rare

Pest (abbreviation)	Life cycle and Number of generations	Description of Damage	Conditions which favor infestation or damage	Pest Status in MI & OH
Japanese beetle adults	Larvae (grubs) feed on roots of many hosts and overwinter. Adults emerge in mid-summer and feed on hundreds of hosts, including soybean. Adults may persist into fall. Eggs laid in the soil in July-Sept. 1 generation per year	• Beetles feed between the veins of leaves, leaving a skeletonized appearance • A pheromone draws beetles together to feed & mate, so leaf injury may look dramatic. Don't be fooled - damage is often patchy & limited to upper leaves on field edges	• Field edges near favorite hosts (wild grape, ornamentals) or turf (with high grub infestation) may have more beetles and damage	Occasional JB is common in Michigan & Ohio soy fields, but we have yet to see a field that justified spraying
seedcorn maggot (SCM)	Pupae overwinter in soil. Adult flies emerge in early spring (mid-April in OH & southern MI), laying eggs in tilled / disturbed soil with decaying organic matter. Larvae (maggots) feed primarily on decaying matter, but also on seeds and emerging seedlings. Several generations per year. The first (damaging) generation is done by mid-May in Ohio and in central/ southern Michigan.	• Larvae feed on germinating seeds, resulting in variable emergence, stand loss, and delayed development • Plants that do emerge often have scarring on cotyledons • Damage can occur over a large part of field Note: maggots may be present when seeds rot for another reason such as pathogens or wet conditions	• Tillage • Recently (w/in 2 weeks) incorporated organic matter such as alfalfa, green cover crops, weeds, or fresh manure • Cool, wet weather which delays emergence • Peak egg laying near planting time in mid-April (MI)	Localized Occurs under specific field conditions
silver-spotted skipper	Pupae overwinter. Adults emerge in May and lay eggs on several hosts, including soy. Small caterpillars cut and fold a section of leaf to make a shelter. Larger larvae roll several leaves together. Older instars are distinctive with a yellow body, constricted red 'neck', oversized head, and orange eye spots. 2 generations per year	• Larvae feed on leaves around their shelter	• Nothing specific	Uncommon Larvae are weird-looking and get noticed during scouting, but they are harmless.
slugs & snails	Slugs overwinter as eggs & adults, so both may be present at planting. Females deposit eggs in soil. These hatch in about one month. Multiple overlapping generations	• Feed on seeds, cotyledons, & leaves, usually at night • Heavy feeding on young plants may slow stand development or even cause stand loss	• No or reduced till • Planting into heavy stubble, crop residue • Cool, wet weather which delays emergence • Stand loss can occur when furrows are poorly-closed as slugs enter and feed down the slot	Localized Occurs under specific field conditions
soybean aphid (SBA)	Eggs overwinter on buckthorn trees. Females move from buckthorn to soybeans in spring; depending on the planting date, fields can miss being colonized at this time. Aphids - all female - reproduce quickly, giving live birth to nymphs. During the summer, winged migrants invade new fields. In the fall, females and a generation of males return to buckthorn. This is the only time mating occurs, between males and the daughters of the females. Eggs are laid near buds on buckthorn. Multiple overlapping generations	• All stages suck plant sap, removing water and nutrients. • Large infestations can impact yield by reducing pod number, beans per pod, and bean size, and cover plants with sticky honey dew and sooty mold • In sandy fields, top-down symptoms of K deficiency (yellow leaf margins, leaf cupping, stunting) can occur • SBA also transmits soybean mosaic virus. This virus does not limit yield in our area, but discoloration of seed can occur	• Late-planted or double-cropped fields are often overwhelmed by summer migrants, resulting in heavy infestation • K deficiency leads to heavy infestation because aphids grow faster, reproduce sooner & more • Drought stress enhances damage & reduces onset of aphid-killing fungi	Occasional to Important *SBA was a major pest for a decade after its discovery in the 2000s. But currently in MI and OH, fields that are over threshold are uncommon due to high levels of biocontrol*

Pest (abbreviation)	Life cycle and Number of generations	Description of Damage	Conditions which favor infestation or damage	Pest Status in MI & OH
soybean gall midge **NOTE**: there is a **similar-looking native midge** (an orange maggot) that feeds on white mold!	First documented in Nebraska in 2011, now spreading east. Larvae overwinter in soil, then pupate in spring. Adults (tiny flies) don't feed, but lay eggs at the base of soy plants. Mature larvae are bright orange maggots. They feed on stems and drop off plants to pupate. 2 generations per season?	• Larvae feed at the base of plants in the early vegetative through reproductive stages • Signs of infestation include brown discolored stems; wilting, broken, or lodged plants; and dead plants • Damage often is first seen in rows on the field edge	• Infestation usually heaviest on edges next to last-year's soybean	None Current (2025) distribution: IA, MN, MO, ND, NE, and SD **This pest is NOT PRESENT YET in Michigan or Ohio**
soybean looper	One of the most abundant pests of soybean in the southern US. Adults migrate from the south, arriving mid to late season (July/ August).	• Larvae defoliate plants and in rare cases feed on pods	• Nothing specific	Uncommon We have never seen high popula-tions in our area
spider mites *two-spotted*	Adults overwinter in field borders and sheltered areas. In spring, adults move to new growth and lay eggs on the undersides of leaves. Mites spread from field to field by crawling or blowing in the wind. Multiple overlapping generations	• Adults & nymphs pierce and dehydrate individual plant cells, resulting in tiny yellow spots (stippling) • Severe damage results in leaf yellowing, leaf death/drop, and water loss • Webbing is a sign of a heavy infestation	• Prolonged hot, dry weather favors an outbreak and enhances the impact of feeding • Infestations often start on dusty edges of fields	Sporadic Outbreaks occur in hot, dry seasons
stink bugs *multiple species* Note: some stink bug species are predators of other insects	Adults overwinter and emerge in spring to complete a generation on weeds, clover, & wheat. Sampling in Michigan shows that bugs tend to move into soybean fields after wheat is harvested. Egg masses are laid on soybean leaves. Adults and nymphs feed by injecting digestive enzymes and sucking plant juices from stems, leaves and pods.	• Pod feeding can result in shriveled, deformed, smaller, or discolored beans. In some specialty beans like those grown for natto, stink bug punctures may not be apparent until processing • Punctures also are entry points for plant pathogens • Stink bug feeding can be related to 'stay green' syndrome	• For brown stink bug - fields near wheat • For the invasive brown marmorated stink bug - fields near woods or buildings	Occasional in bulk soybean Important in edible specialty beans like natto
thistle caterpillar *AKA painted lady butterfly*	Adult butterflies migrate from the south, arriving in June. Eggs are laid on many hosts, including beans. Caterpillars feed on leaves and pupate on the plant. 2 generations per year	• Caterpillars web and fold leaves together to make a distinctive shelter, then feed in and around the structure	• Nothing specific	Uncommon Outbreaks are rare, but webbed leaves & the spikey colorful larvae are noticed during scouting
thrips *several species*	Soybean thrips migrate from the south, but other species may be local. Eggs are inserted into plant tissue. Juveniles and adults both feed on (suck) leaf tissue.	• Thrips feed in a unique way using a single mandible to 'punch' into and rupture individual plant cells, then suck up the contents. Ruptured cells collapse • Leaves with a lot of damaged cells have a silvery appearance • Thrips also transmit soybean vein necrosis disease	• Prolonged hot, dry weather favors an outbreak and enhances the impact of thrips feeding •Thrips develop in small grain fields first and may move into adjacent soybeans after dry-down	Uncommon Thrips are very abundant on soybeans, but rarely cause damage
webworm *garden & alfalfa webworm*	Overwinter as pupae. Moths emerge and lay eggs on many crops and weeds. Caterpillars tie leaves together with webbing and feed in a silk-lined shelter. 2 generations per year	• The tied shelter can have both windowpane damage and defoliation; under heavy infestation, leaves may be entirely skeletonized, dry out and turn brown	• Patchy infestations can occur in areas with pigweed (a favorite host) or near alfalfa	Uncommon

Pest (abbreviation)	Life cycle and Number of generations	Description of Damage	Conditions which favor infestation or damage	Pest Status in MI & OH
white grubs - annual *including Japanese beetle, Asiatic garden beetle (AGB)*	Adults emerge in June into July, depending on species. Eggs are laid in soil during July-August. Grubs feed on roots through the fall, then move down in soil profile to overwinter. 1 generation per year	• Mature grubs overwinter in fields, then feed again the next spring on cotyledons and roots of seedlings at planting time • May reduce stand or increase variability • Japanese beetle adults feed on soybean leaves (see Japanese beetle in list)	• Fields or parts of fields with >80% sand (AGB) • Planting into fallow fields or pasture, or field margins near turf (JB)	Localized We have seen soybean stand loss from AGB in sandy fields in southern MI & northern OH
white grubs - June beetle	Adults emerge in May/June, move and mate at dusk (often come to lights). Eggs laid in soil. Grubs feed for three summers, with 2nd and 3rd stage grubs causing the most damage to roots. Between summers, larvae move to a lower depth in soil. Late in the 3rd summer, grubs pupate underground; adults overwinter until next spring. 1 generation takes three years	• Grubs may be present for the entire season, feeding on roots and cotyledons of seedling as well as roots of larger plants • At planting, may reduce stand and uniformity; later in season, symptoms include wilting, water and nutrient deficiency, or plant death	• Sandy fields or parts of fields • Planting into fallow fields & pasture	Uncommon & Localized In Michigan, there have been a few cases of stand loss in sandy fields in the Thumb
wireworm *multiple species*	Wireworms are the immature form of click beetles. They spend up to six years in the immature stage. Overlapping generations.	• Feed on newly planted soybean seeds & roots	• Planting into long-standing fallow fields & pasture	Uncommon & Localized

Table 4: Management notes, scouting recommendations, and thresholds for insect pests of soybean in Michigan and Ohio

The defoliation recommendation in this guide was updated recently based on results from a grower-funded regional research project in the Midwest. **For details on assessing defoliation, see the pages following this table.**

Pest	Notes on non-chemical and chemical management	Scouting recommendation	Threshold
bean leaf beetle (BLB)	• Environment: Extended periods of subfreezing winter temperatures can increase death of overwintering beetles	For general detection of beetles, use a sweep net To estimate defoliation, use the leaflet method described on the pages following this table	Overall defoliation threshold: • V stages - R2: 30% • R3 - R5: 10% • R6: 15% Threshold for pod feeding: 10%
caterpillars	*The leaf-feeding caterpillars (cloverworm, earworm, skipper, soybean looper, thistle caterpillar, velvetbean caterpillar, webworm) do similar damage and can be grouped together for management recommendations* • Biological: Natural enemies keep most species in check	For general detection, use a sweep net To estimate defoliation, use the leaflet method described on the pages following this table	Overall defoliation threshold: • V stages – R2: 30% • R3 - R5: 10% • R6: 15%
cutworm *including black and variegated cutworm*	• Biological: Ground beetles and parasitoids kill larvae • Agronomic: Good weed control and timely cover crop termination reduce likelihood of infestation • Insecticide: Rescue (post-planting) treatments are effective and preferred, as cutworm is uncommon in soybean	Walk fields to check stand. Larvae feed at night and on overcast days. During the day, dig around base of plants to locate them Pheromone traps for black cutworm can and aid in timing of scouting	Guideline: Treat if reduction in stand count is unacceptable based on target plant population (soy can compensate for some stand loss)
grasshoppers *several species including red-legged & differential*	• Biological: Blister beetle larvae prey on eggs, while insects, birds, and mammals eat nymphs & adults. Fungal pathogens kill eggs and nymphs under wet spring conditions • Agronomic: Tillage reduces survival of eggs and newly hatched nymphs • Insecticide: May be able to limit spray area if hoppers invade from a neighboring field or grassy border	No specific recommendation To estimate defoliation, use the leaflet method described on the pages following this table	Overall defoliation threshold: • V stages - R2: 30% • R3 - R5: 10% • R6: 15%
green cloverworm	*See "caterpillars"*		
Japanese beetle adults	• Insecticide: May be able to limit spray area to the edge, since beetles often congregate there	To estimate defoliation, use the leaflet method described on the pages following this table	Overall defoliation threshold: • V stages - R2: 30% • R3 - R5: 10% • R6: 15%
seedcorn maggot (SCM)	• Agronomic: Delay planting at least 2 weeks into disced cover crops, weeds, manure, or heavy residue. It is especially important to avoid early (mid-April) planting under these circumstances when cold soils delay emergence • Agronomic: SCM almost never infests no-till fields • Insecticide: Management is essentially preventative. If choosing to plant early and into a recently tilled field, an insecticide seed treatment can help, but it may not be very effective if the maggot population is high. Stand loss can still occur when treated seed is used • A degree day model predicts when peak flight & egg-laying will occur based on MSU weather station data. See this site: https://enviroweather.msu.edu/crops/corn	No specific recommendation To assess potential risk of SCM before planting, check the degree day model listed in the previous column	No rescue treatment. Consider replanting fields or areas with significant stand loss An insecticide seed treatment is not recommended when replanting, as SCM risk has passed
silver-spotted skipper	*See "caterpillars"*		

Pest	Notes on non-chemical and chemical management	Scouting recommendation	Threshold
slugs & snails	• Biological: Some ground beetle species consume slugs • Agronomic: Tillage and crop rotation reduce residue (slug habitat). Row cleaners can sweep away residue and create a warm band of soil above the seed bed • Agronomic: Avoid planting in wet conditions that leave open furrows which serve as slug buffet lines • Insecticide: Slugs are not insects, so soil insecticides and neonicotinoid seed treatments (NSTs) do not kill them. In fact, NSTs can increase slug problems because slug-eating ground beetles are killed by the insecticide.	No specific recommendation Place shingles in fields before planting to detect slugs, which hide under them during the day	None established Consider treating and replanting fields or areas with significant stand loss
soybean aphid (SBA)	• Biological: Numerous predators and several species of parasitoids keep SBA in check in recent years. Later in the season, aphids are also controlled by insect-killing fungi • Agronomic: In fields with sandy soils, adequate potassium levels reduce SBA risk and yield loss • Insecticides: Timing and coverage are key. <u>Do not</u> spray early (populations below the threshold). This disrupts natural enemies and aphid numbers can quickly rebound. Insecticide resistance is reported in aphid populations in western states - insurance or early sprays created the problem. If the threshold is reached, use nozzles which provide good coverage and a high enough water volume to achieve excellent coverage	Begin scouting at end of June. Sample a minimum of 30 whole plants, taking several paces between them. Count & record the total # of SBA on each, including '0s'. A tally counter makes it much easier to count. Then calculate the average # per plant *[In practical terms, if the top-third of every plant is covered with several hundred juicy green healthy-looking aphids, this is likely threshold]* For quicker sampling, google the "Speed Scouting" technique developed by Iowa State University	Economic threshold: • R1-R5: 250 per plant • After R5: <u>don't treat</u> You have ~7 days to treat after reaching threshold, as lag time was built into the threshold <u>Factors to consider</u>: * Are there numerous predators beginning to control the aphids? *Are there fungus-killed aphids, which suggests population is about to crash? * Are the aphids tiny 'white dwarves' which indicates a decreasing population?
soybean gall midge	• Agronomic: Infestations start on field edges adjacent to previous year's soybean **Gall midge has not been found in MI or OH. If you suspect it, contact one of the authors or an Extension Educator.**	Split bases of wilted, broken, or dead plants in edge-rows. Check for black tissue and bright orange maggots	**Gall midge has not yet been found in Michigan or Ohio**
soybean looper	*See "caterpillars"*		
spider mites *two-spotted*	• Biological: Under humid conditions, a natural fungal pathogen can infect and wipe out mites in a matter of days. Some natural enemies consume mites • Agronomic: Irrigation reduces the impact of spider mite feeding and increases humidity for fungal pathogens, but in a prolonged drought, even irrigation isn't enough • Environmental: Rainfall has a similar effect as irrigation • Insecticide: Insecticide resistance is common in spider mite. Some insecticides (including most pyrethroids) sprayed to control insects will flare mite populations by killing natural enemies. Fungicides may also flare mites by disrupting natural fungal pathogens. Therefore, insurance applications of both are discouraged and be extra cautious about pesticide applications in dry seasons.	Infestations often start on field edges. Confirm mites are present by tapping leaves over a paper plate or piece of paper (black construction paper works well) Also look for stippling and yellowing of leaves	Guideline: Treat when stippling is widespread on lower leaves and progressing into the middle canopy <u>Factors to consider</u>: * Will the forecast remain favorable for mites, i.e. hot & dry? * Is excellent spray coverage possible? * Will there be yield loss from running over beans?
stink bugs *multiple species*	• Biological: Several parasitoids attack egg masses or bugs	Use a sweep net to take 5 sets of 20 sweeps across the field	Guideline: 40 stink bugs in 100 total sweeps
thistle caterpillar	*See "caterpillars"*		

Pest	Notes on non-chemical and chemical management	Scouting recommendation	Threshold
thrips *(several species)*	• Biological: Many small-sized natural enemies (pirate bugs, predatory mites, predatory thrips) build their populations by feeding on thrips. Interesting, some thrips provide biological control by feeding on spider mite eggs! • Insecticides: Seed treatments may control thrips for a few weeks after soy emergence. However, this removes a source of prey to build natural enemy populations in soy	Pick leaves from several locations in the field, from the mid-canopy Use a hand lens to count the total number of thrips per leaf	Guideline: 8 thrips per leaf We have seen 'sprayable' numbers only once, during the terrible 2012 drought
webworm	*See "caterpillars"*		
white grubs *including Japanese beetle, Asiatic garden beetle (AGB), and June beetle*	• Biological: Grubs are eaten by other insects, birds, and rodents; infected by several pathogens; and attacked by several species of beneficial nematodes • Agronomic: If practical, fall plowing of at-risk fields is recommended. For Asiatic garden beetle in southern Michigan and northern Ohio, planting later may avoid most feeding • Insecticide: Grubs have 'eaten through' seed treatments in many cases. Rescue treatments are not available Note: it is important to identify grubs in the field to distinguish annual species from June beetles, which remain in fields for multiple seasons	No specific recommendation Grubs tend to be patchy, often in the sandiest parts of fields. Fields with a history of grubs can be checked with a shovel in early spring	No rescue treatment is available Consider replanting fields or areas with significant stand loss
wireworm	• Agronomic: Depending on species, wireworms remain in the larval stage for 1 to 6 years, thus they are favored by undisturbed soil. If practical, fall plowing of long-standing fallow & pasture prior to planting is recommended • Insecticides: Seed treatments may be helpful. Rescue treatments are not available	No specific recommendation	No rescue treatment is available Consider replanting fields or areas with significant stand loss

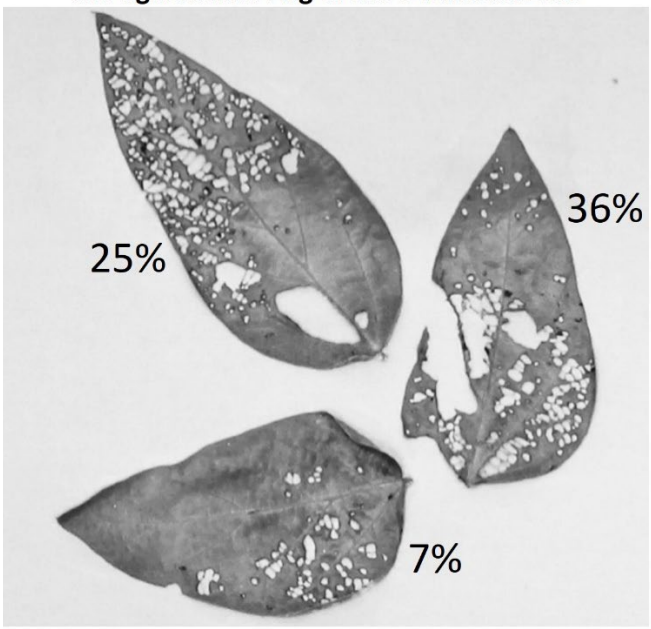
See the following pages for information on assessing defoliation

Insect defoliation in soybean

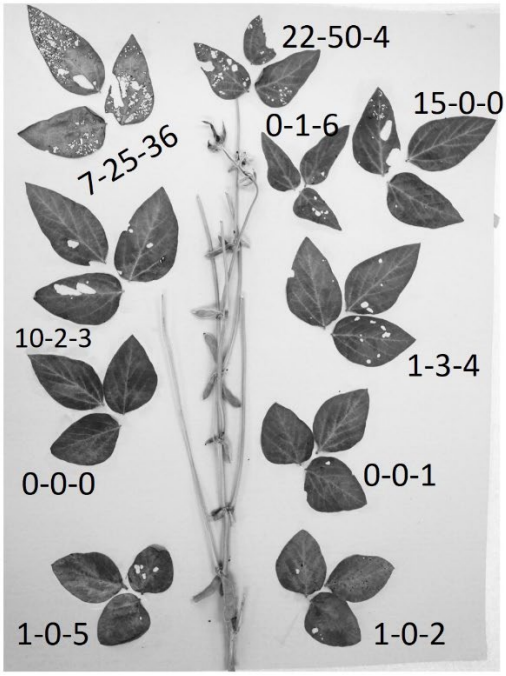
Soybean is attacked by many defoliators, including bean leaf beetle, Japanese beetle, looper, cloverworm, and grasshoppers. Management decisions are based on the combination of their feeding.

There is a tendency to overestimate insect defoliation by limiting scouting to field edges (where insects like Japanese beetle accumulate) or by focusing the eye on the most-heavily damaged leaves (usually ones at the top of a plant). In the example below, a scanner was used to measure % defoliation accurately for each leaflet on a whole plant. The three leaflets on the most-damaged leaf (left) averaged 23% defoliation. But the true average defoliation for the whole plant (right), based on all 30 leaflets, was only 7%.

Misleading defoliation estimate based on the ugliest leaf. Avg of the 3 leaflets: 23%



Whole plant estimate (30 leaflets): 7%



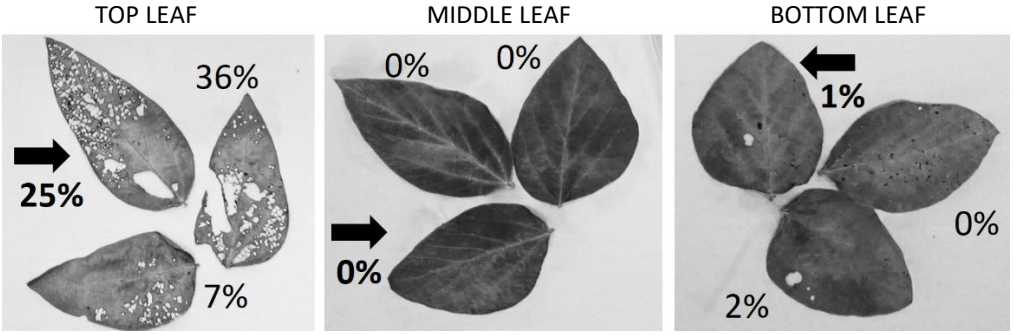
When defoliation is determined properly by assessing feeding on whole plants across an entire fields, few soybean fields reach threshold in Michigan or Ohio. Even if some insect feeding is present on upper leaves or edge plants, soybeans have a high capacity to compensate for defoliation because lower leaves or neighboring undamaged plants 'pick up the slack'. The following page gives a recommended method to measure defoliation when scouting fields.

The Leaflet Method to Assess Defoliation

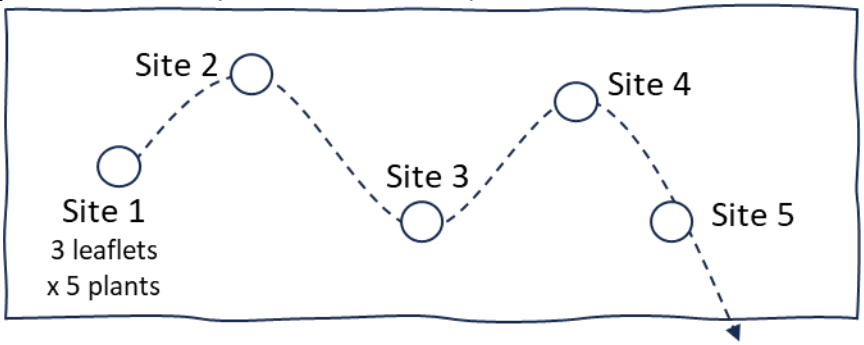
You need a small container or bag to collect leaflets + a way to take data/ calculate an average

[start at least 20 feet beyond the field edge]

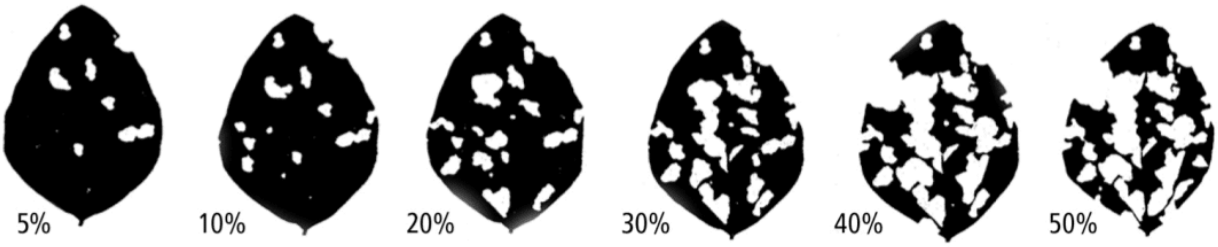
1. Pick a trifoliate leaf from the bottom, middle and top of a plant, as in the pictures below. From each leaf, discard the least- and most-damaged leaflet and keep only the three leaflets with the 'middle' amount of defoliation (arrows below). Don't rate defoliation yet, simply throw away the leaflets with least and most feeding, based on your quick visual impression.



2. Sample four more plants, 10 paces apart, for a total of 15 leaflets at this site (5 plants x 3 leaflets). Then repeat the process at four more sites across the field, as in the diagram below. Your total sample is 75 leaflets (15 leaflets x 5 sites).



3. Estimate and record the % defoliation for each leaflet. This is easiest done outside the field. Estimates can be made visually (the scale below helps to visualize different levels of feeding) or digitally using a phone app like Bioleaf https://www.quantitative-plant.org/software/bioleaf.



4. Finally, average the scores from the 75 leaflets to get an estimated % defoliation for the field.

Table 5: Soil/at-plant insecticides to manage insect pests of soybean in Michigan and Ohio

- Insecticides are grouped by active ingredient(s), which are listed alphabetically, allowing for easy comparison of products with the same chemistry.
- Application rates are listed for pests which appear on the manufacturer label; If a column is blank, the pest is not on the label. The letters in the pest columns refer to the label use rate from column two.
- Note that insecticide rates per 1000 feet of row are based on a **30-inch row spacing**. See label for specific per-acre rate and gauge-setting charts for narrower row spacing.

Active ingredient Trade Names	**Labelled rate(s)** per 1000 feet of row or per acre	**seedcorn maggot**	**slugs & snails**	**white grubs**	**Precautions and Remarks**
bifenthrin Xpedient Plus V	(a) 0.15 – 0.30 oz per 1000 ft (= 2.56 - 5.12 oz per acre)	a		a	• Apply as a band over row on soil surface, T-banded over an open furrow, or in-furrow; see label for PRE and PPI instructions • Many are formulated to mix directly w/ fertilizer or PRE herbicide applications Note: Many of these products can be broadcast on the soil surface to control cutworm species and armyworms
Bifender FC	(a) 0.17 - 0.34 oz per 1000 ft (= 3.0 - 5.9 oz per acre)				
Capture 3RIVE3D	(a) 0.19 – 0.46 oz per 1000 ft (= 3.2 - 8 oz per acre)				
Bifenture LFC Capture LFR Nirvana RTU Sniper LFR	(a) 0.2 - 0.39 oz per 1000 ft (= 3.4 - 6.8 oz per acre)				
bifenthrin + biofungicide Ethos XB Ethos Elite LFR	(a) 0.2 - 0.49 oz per 1000 ft (= 3.5 - 8.5 oz per acre)	a		a	• Similar to bifenthrin alone, but contains a biological fungicide for suppression of early season root diseases (apply in-furrow for disease control): XB: *Bacillus amyloliquefaciens* Elite: *Bacillus velezensis & subtilis* • Apply T-band or in-furrow. See label for PRE and PPI instructions and for other row spacings
bifenthrin + fungicide Nirvana Complete	(a) 0.29 – 0.75 oz per 1000 ft (= 5.0 – 13.0 oz per acre)	a		a	• Combo product with the fungicide pyraclostrobin - similar precautions to bifenthrin alone. The rate of bifenthrin is similar to the high rate in bifenthrin-only products
cypermethrin (zeta) Mustang Maxx	(a) 0.23 oz per 1000 ft (= 4 oz per acre)			a	• Apply T band or in-furrow in a minimum of 2-7 gal per acre
iron phosphate Ferroxx AQ	(a) 4.0 – 15.0 lbs per acre		a		• Sluggo is a bait that must be eaten to kill slugs • Apply in the evening. Scatter pellets using a broadcast spreader & use a higher rate for severe infestations or after long periods of rain • OMRI certified for use in organic fields
Sluggo	(a) 20 - 44 lbs per acre				
metaldehyde Deadline Bullets	(a) Max 10 lbs per acre		a		• **Metaldehyde baits are NOT registered for use on soybean in Michigan - only for use in Ohio!** (yes, this is an unusual restriction) • Deadline is a bait and must be eaten to kill slugs • Growth stages V0-R1: no application after R1 • Apply in the evening as a band between rows. • Avoid applying before a rain or irrigation, which can dissolve the pellets
Deadline GT	(a) Max 13.3 lbs per acre				
Deadline M-Ps	(a) Max 10 lbs per acre				
Durham Metaldehyde 7.5	(a) Max 5.3 lbs per acre				
sodium ferric EDTA Ferroxx Slug & Snail Bait	(a) 5 – 20 lbs/acre		a		• Broadcast uniformly using a spreader • Non-toxic to pets and wildlife

Table 6: Foliar insecticides to manage insect pests of soybean in Michigan and Ohio

- Insecticides are grouped by active ingredient(s), which are listed alphabetically, allowing for easy comparison of products with the same chemistry
- Application rates are listed for pests which appear on the label. If a column is blank, the pest is not on the label. The letters in the pest columns refer to the use rate from column two
- Note: The caterpillar category includes cloverworm, earworm, silver-spotted skipper, soybean looper, thistle caterpillar, velvetbean caterpillar, and webworm. These are combined because they defoliate soybeans in the same way

Active ingredient Trade Names	**Labelled rate(s) per acre** (unless stated)	**bean leaf beetle**	**caterpillars**	**cutworm**	**grasshoppers**	**Japanese beetle**	**soybean aphid**	**spider mite**	**stink bugs**	**thrips**	**Pre-harvest interval (PHI) in days**	**Precautions and Remarks**
abamectin Agri-Mek SC	(a) 1.75 - 3.5 oz							a			28	• Apply when spider mites are first observed • To avoid illegal residues, product must be mixed with a specific spray adjuvant. See label for details • For best control, apply by ground instead of air • Maximum two sequential applications of an abamectin product
acephate Acephate 90 Prill Acephate 90 WDG Acephate 90 WSP Acephate 97 UP Acephate 97 WDC Orthene 97	(a) 0.28 - 0.56 lbs (b) 0.56 - 1.1 lbs (c) 0.83 - 1.1 lbs (a) 0.25 - 0.5 lbs (b) 0.5 - 1.0 lbs (c) 0.75 - 1.0 lbs	c	c		a		c		b	a	14	• Do not graze or use treated vines for hay or forage
acetamiprid + bifenthrin Savoy EC	(a) 2.5 – 5.0 oz	a	a				a				30	• Use of a non-ionic surfactant, crop oil or seed oil is recommended to improve coverage, uptake, and pest control • Soy looper not listed. Label lists fewer species than bifenthrin alone
afidopyropen Sefina	(a) 3.0 oz						a				7	• Controls sucking pest by disrupting feeding and other behaviors, creating 'zombie' aphids that die a slow death
Bacillus thuringiensis - Bt Agree WG Xentari Dipel DF Javelin WG	(a) 0.25 - 2.0 lbs (a) 0.5 - 2.0 lbs (a) 0.5 – 1.0 lbs (a) 0.25 - 1.5 lbs		a								0	• Bts must be eaten to kill and are most-effective against young larvae (early instars), so coverage is critical • Check label for rates for specific caterpillars and pest pressure • Some can be used in organic production • Note, the Dipel DF label indicates it should be tank mixed with a pyrethroid (the reason for this is not given)

Active ingredient Trade Names	**Labelled rate(s) per acre** (unless stated)	**bean leaf beetle**	**caterpillars**	**cutworm**	**grasshoppers**	**Japanese beetle**	**soybean aphid**	**spider mite**	**stink bugs**	**thrips**	**Pre-harvest interval (PHI) in days**	**Precautions and Remarks**
bifenthrin (liquid) Bifen2 AgGold Bifenture EC Bifenthrin 2EC Brigade 2EC Discipline 2EC Fanfare EC / 2EC/ ES Reveal & Reveal EndurX Sniper & Sniper Helios Tundra EC Bifender FC Nirvana RTU	(a) 2.1 - 6.4 oz (b) 5.12 - 6.4 oz (a) 2.4 - 7.4 oz (b) 5.9 - 7.4 oz (a) 2.8 - 8.5 oz (b) 6.8 - 8.5 oz	a	a	a	a	a	a	b	a	a	18	• Do not make applications less than 30 days apart
bifenthrin (dry) Bifenture 10DF	(a) 5.3 – 16.0 oz (b) 12.8 – 16.0 oz						a	b			18	• Dry (wettable powder) formulation • At the high rate (16 oz) use at least 10 gal per acre
bifenthrin + biofungicide *(Bacillus amyloliquefaciens)* Ethos XB	(a) 2.8 - 8.5 oz (b) 6.8 - 8.5 oz	a	a	a	a	a	a	b	a	a	18	• Combo product with a bio fungicide labeled for suppression of white mold and several other foliar pathogens. Similar precautions to bifenthrin alone
bifenthrin + fungicide Nirvana Complete	(a) 13 oz	a	a	a	a	a	a	a	a	a	18	• Combo product with pyraclostrobin fungicide. Similar precautions to bifenthrin alone. Bifenthrin rate is equivalent to the high rate in bifenthrin-only products
bifenthrin + acetamiprid Argyle OD	(a) 6.0 - 9.0 oz (b) 7.0 - 9.0 oz	a	a	a	a	a	a	b	a	a	30	• A spray adjuvant, such as a non-ionic surfactant or methylated seed oil, is recommended to improve coverage and plant uptake
bifenthrin + chlorantraniliprole Elevest	(a) 4.8 - 9.6 oz (b) 5.6 - 9.6 oz (c) 7.7 - 9.6 oz	a	b	a	a	a	a	c	b	a	18	• For aphids and spider mites, coverage is essential • For grasshoppers, performance improved by adding methylated seed oil • Highly toxic to fish & aquatic life and to bees exposed directly
bifenthrin + cypermethrin Steed Hero Hero EW	(a) 2.5 - 3.5 oz (b) 3.5 - 4.7 oz (a) 2.6 - 6.1 oz (b) 4.0 - 10.3 oz (c) 10.3 oz (a) 2.8 - 6.7 oz (b) 4.5 - 11.2 oz (c) 11.2 oz	b	b	a	b	b	b	c	b	b	21	• Do not graze or harvest treated foliage for livestock feed

Active ingredient Trade Names	**Labelled rate(s) per acre** (unless stated)	**bean leaf beetle**	**caterpillars**	**cutworm**	**grasshoppers**	**Japanese beetle**	**soybean aphid**	**spider mite**	**stink bugs**	**thrips**	**Pre-harvest interval (PHI) in days**	**Precautions and Remarks**
bifenthrin + imidacloprid Brigadier Skyraider Swagger	(a) 5.1 - 6.1 oz (a) 2.1 - 6.0 oz (b) 5.12 - 6.0 oz (a) 7.6 - 12.2 oz (b) same for mites	a	a	a	a	a	a	b	a	a	21	• Highly toxic to bees • Do not make applications less than 30 days apart
bifenthrin + sulfoxaflor Ridgeback	(a) 4.5 – 13.8 oz (b) 6.9 – 13.8 oz (c) 11.0-13.8 oz	a	a	a	a	a	b	c	a	a	18	• Highly toxic to bees • Do not make applications less than 30 days apart
carbaryl Carbaryl 4L Sevin 4F Sevin XLR Plus	(a) 0.5 - 1.5 qts	a	a	a		a			a	a	21	• Check label for specific rates for various pest species • Bee warning. May kill honeybees. If application can't be avoided and the crop is blooming, limit application to within 2 hrs of sunrise or sunset. Notify beekeepers within 1 mile, 48 hrs prior • Do not apply this product w/ 2-4 D herbicide (can result in crop injury)
chlorantraniliprole Coragen Prevathon Shenzi 400SC	(a) 3.5 - 5.0 oz (a) 14 - 20 oz (a) 1.7 – 3.8 oz		a		a						1	• Novel mode of action; insects are paralyzed & stop feeding. Must be applied before populations reach damaging levels. See label for specifics. • Check labels for specific species targets, as they differ: Coragen = earworm, armyworm. Prevathon & Shenzi = earworm, armyworm, loopers, cloverworm, velvetbean caterpillar & hoppers
chlorantraniliprole + lambda-cyhalothrin Besiege	(a) 5.0 - 10.0 oz	a	a	a	a	a	a		a	a	30	• Check label for specific rate ranges (5-8 oz, 8-10 oz) for various species • May 'suppress' spider mites • Do not graze or feed treated foliage to livestock
clothianidin Belay	(a) 3 - 6 oz	a				a	a		a		21	• Do not use Belay in fields where neonicotinoid treated seed was used, until 45 days after planting. Max 0.2 lb clothianidin per acre per year. • Bee hazard warning. Toxic to bees for up to 5 days after application. Do not apply during flowering & see label for other pollinator precautions. • Do not graze or feed treated foliage to livestock
cyfluthrin Tombstone Tombstone Helios	(a) 0.8 - 1.6 (b) 1.6 - 2.8 (c) 2.0 - 2.8	b	b	a	c	b	c		b	a	45 seed 15 forage	• Helios formulation has UV protection for extended residual
cyfluthrin (beta) Baythroid XL	(a) 0.8 - 1.6 (b) 1.6 - 2.8 (c) 2.0 - 2.8	b	b	a	c	b	c		b	a	21 seed 15 hay & forage	

Active ingredient Trade Names	**Labelled rate(s) per acre** (unless stated)	**bean leaf beetle**	**caterpillars**	**cutworm**	**grasshoppers**	**Japanese beetle**	**soybean aphid**	**spider mite**	**stink bugs**	**thrips**	**Pre-harvest interval (PHI) in days**	**Precautions and Remarks**
cyfluthrin + imidacloprid Leverage 360	(a) 2.8 oz	a	a	a	a	a	a		a	a	21 seed 15 hay & forage	
cyhalothrin (gamma) Declare Proaxis	(a) 0.77 - 1.28 oz (b) 1.28 - 1.54 oz (a) 1.92 - 3.2 oz (b) 3.2 - 3.84 oz	a	a	a	b	b	a		b	a	45	• Do not graze or feed treated foliage to livestock
cyhalothrin (lambda) Warrior II w/ Zeon Tech. Grizzly Too Kendo 22.8CS Lamcap II Province II Ravage II Lambda-Cyhalothrin 1EC Lambda-Cy EC, 1EC, & AG Lambda-T LambdaStar Kendo Paradigm VC Ravage Silencer	(a) 0.96 - 1.60 oz (b) 1.60 - 1.92 oz (a) 1.92 - 3.20 oz (b) 3.20 - 3.84 oz	a	a	a	b	b	a		b	a	30	• Do not graze or harvest treated area for forage or hay
cypermethrin (alpha) Fastac CS & Fastac EC	(a) 1.3 - 3.8 oz (b) 3.2 - 3.8 oz	a	a	a	b	a	a		b	b	21	• Do not graze or harvest treated area for forage or hay
cypermethrin (zeta) Mustang Maxx	(a) 1.28 - 4.0 oz (b) 3.2 - 4.0 oz	a	a	a	b	a	a		b	b	21	• Do not graze or harvest treated area for forage or hay
cypermethrin + afidopyropen Renestra	(a) 6.8 oz	a	a	a	a	a	a		a	a	21	• Afidopyropen controls sucking pests by disrupting feeding & other behaviors, creating 'zombie' aphids that die a slow death • Do not graze or feed hay and forage
deltamethrin Delta Gold	(a) 1.0 - 1.5 oz (b) 1.5 - 2.4 oz	b	b	a	b	b	b		b		21	• Do not graze or harvest treated area for forage or hay
dimethoate Dimate 4E Dimethoate 4EC & 400	(a) 1 pint	a			a		a	a			21	• Highly toxic to bees and other pollinators. Do not apply to blooming crops if bees are present. • Do not graze or feed within 5 days of last application

Active ingredient Trade Names	**Labelled rate(s) per acre** (unless stated)	**bean leaf beetle**	**caterpillars**	**cutworm**	**grasshoppers**	**Japanese beetle**	**soybean aphid**	**spider mite**	**stink bugs**	**thrips**	**Pre-harvest interval (PHI) in days**	**Precautions and Remarks**
emamectin benzoate Denim	(a) 8 – 12 oz		a								28	• Controls only caterpillars. Target small larvae, up to a ½ inch. May need to make at least 2 applications if egg-laying occurs over an extended period • 'Suppresses' spider mite, defined as erratic control from good to poor • Do not graze, harvest, or feed vines for livestock
esfenvalerate Asana XL S-Fenvalostar Zyrate	(a) 2.9 - 5.8 oz (b) 5.8 - 9.6 oz	b	a	b	b	b	b		b		21	• Do not graze or feed livestock on treated fields
etoxazole Stifle SC Zeal SC Zeal Pro	(a) 2.0 - 6.0 oz (a) 2.0 - 6.0 oz (a) 11.5 - 34.6 oz							a			Do not apply after **R5**	• Kills eggs and mites • Minimum 20 gal per acre by ground or 3 gal per acre by air • Maximum 1 application per year. Do NOT apply after the R5 stage. • Do not graze or feed treated area
flupyradifurone Sivanto HL Sivanto 200SL Sivanto Prime	(a) 3.5 - 7.0 oz (a) 7.5 - 10.5 oz (a) 7.0 - 14.0 oz						a				21	• Systemic insecticide, particularly effective on sucking pests
imidacloprid Admire Pro Advise Four Alias4F Montana 4F Nuprid 4FMax Provoke Wrangler Nuprid 2SC Prey 1.6 Sherpa	(a) 1.3 oz (a) 1.5 oz (a) 3.0 oz (a) 3.75 oz	a				a	a				21	• Thorough coverage is needed
Imidacloprid + lambda cyhalothrin Kilter	(a) 1.9 – 3.2 oz (b) 3.2 – 3.8 oz	a	a b	a	b	a	a		b	a	30	• Bee hazard warning – see label for pollinator precautions • See label for rates for specific caterpillar species • Do not graze, feed, harvest treated forage, straw, or hay
indoxacarb Steward	(a) 4.6 - 11.3 oz		a								21	• Use higher rate for higher pest population or spraying a dense canopy • Also labeled for suppression of stink bugs • Do not graze or feed livestock on treated fields

Active ingredient Trade Names	**Labelled rate(s) per acre** (unless stated)	**bean leaf beetle**	**caterpillars**	**cutworm**	**grasshoppers**	**Japanese beetle**	**soybean aphid**	**spider mite**	**stink bugs**	**thrips**	**Pre-harvest interval (PHI) in days**	**Precautions and Remarks**
methomyl Annihilate LV Lannate LV Lanveer LV Nudrin LV Annihilate SP Corrida90WSP Lannate SP Nudrin SP	(a) 0.4 - 1.5 pints (a) 0.125 - 0.5 lbs	a	a				a			a	14 seed 12 hay 3 forage	• Rates vary by insect and by 'severity' of infestation, check labels for details • The Lannate label lists brown marmorated stink bug
methoxyfenozide Intrepid 2F Invertid 2F	(a) 4 - 8 oz		a								14 seed 7 hay & forage	• Unique mode of action on Leps causes caterpillars to molt prematurely • Will only control larvae; apply when first signs of feeding damage appear • Also labeled for various armyworm species • Endangered species warning for these Michigan counties: Allegan, Monroe, Montcalm, Muskegon, Newaygo, Oceana. Visit EPA's 'Bulletins Live!Two' website before application & follow the use limitations given
methoxyfenozide + spinetoram Intrepid Edge	(a) 4.0 – 6.4 oz		a								28	• Unique modes of action specific to Leps • Will only control larvae; apply when first signs of feeding damage appear • Also labeled for various armyworm species • Endangered species warning for these Michigan counties: Allegan, Monroe, Montcalm, Muskegon, Newaygo, Oceana. Visit EPA's 'Bulletins Live!Two' website before application & follow the use limitations given
novaluron Diamond	(a) 6 - 12 oz (b) 9 - 12 oz		a		b				a		30	• Controls only Lepidopteran larvae (caterpillars) and small nymphs of stink bugs & grasshoppers. Applications must be made early in insect life cycle • Do not feed treated vines to livestock
permethrin Perm-Up 25DF Pounce 25WP Arctic 3.2EC PermaStar Ag Perm-Up 3.2EC	(a) 3.2 -12.8 oz (b) 6.4 - 12.8 oz (a) 2.0 - 4.0 oz (b) 2.0 - 8.0 oz	a	b	a		a					60	• Rates range higher for several caterpillar species. Check label • Do not graze or harvest treated area for forage or hay
pyrethrins Evergreen EC 60-6 PyGanic EC 1.4 II PyGanic 5.0	(a) 2.0 - 12.6 oz (a) 16 - 64 oz (a) 4.5 - 15.6 oz	a	a	a	a	a	a		a	a	0 when sprays dry	• Plant-derived insecticides that knock down insects quickly but have short residual control, so coverage is critical • PyGanic is OMRI listed for use on organic crops, but Evergreen is not • Highly toxic to bees exposed to direct treatment; do not apply on or drift onto blooming crops or weeds
spinetoram Radiant SC	(a) 2.0 - 4.0 oz		a								28	• Time applications to target small larvae • Not all caterpillar species are listed on the label

Active ingredient Trade Names	**Labelled rate(s) per acre** (unless stated)	**bean leaf beetle**	**caterpillars**	**cutworm**	**grasshoppers**	**Japanese beetle**	**soybean aphid**	**spider mite**	**stink bugs**	**thrips**	**Pre-harvest interval (PHI) in days**	**Precautions and Remarks**
spinosad Blackhawk Tracer	(a) 1.1 - 2.2 oz (a) 1.0 - 2.0 oz		a								28	• Time applications to target small larvae • Not all caterpillar species are listed on the label • Do not feed treated forage or hay
sulfoxaflor Transform WG	(a) 0.75 - 1.0 oz						a				7	• Translaminar product, moves within leaf to target sucking pests • Label lists 'suppression' of stink bugs at a 2-2.25 oz rate
thiamethoxam + lambda cyhalothrin Endigo ZC Endigo ZCX	 (a) 3.5 – 4.0 oz (b) 4.0 - 4.5 oz	 b	 a	 a	 b	 b	 a	 	 b	 a	 30	• Highly toxic to bees exposed to direct treatment. Do not apply on or drift onto blooming crops or weeds • Stink bug control may require multiple applications • Do not graze or harvest soybean for livestock forage, straw, or hay