MSU Field Crops Insect Guide: Management of Insects and Spider Mites in Dry Beans
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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 on **dry beans**. 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 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.

Dry beans Table 1. Timing of damage from common insects and related pests in Michigan
Pests are listed from early to late-season. Key species are highlighted in bold text.

Common name	Overwintering stage, location	May	June	July	August	September
seedcorn maggot	pupae, in soil	larvae (maggots) feed on seeds and scar cotyledons				
slugs & snails	both eggs and adults, in field	juveniles and adults feed on seedlings				
white grubs	larvae (grubs), underground	larvae (grubs) feed on roots				
aphids (usually black bean & cotton aphids)				nymphs and adults pierce leaves, feed on plant sap		
grasshoppers (multiple species)	egg clusters, underground			nymphs and adults feed on leaves		
green cloverworm	Southern USA, migrate north			larvae (caterpillars) feed on leaves and pods		
Mexican bean beetle	adults, in protected areas			larvae and adults skeletonize leaves		
potato leafhopper	Southern USA, migrate north			nymphs and adults suck plant sap		
spider mite	adult females, at base of hosts			nymphs and adults pierce plant cells, suck plant sap		
Lygus / tarnished plant bug	adults, in protected areas			nymphs and adults suck plant sap		
thrips	depends on species			nymphs and adults 'punch' individual cells, suck plant sap		
western bean cutworm	prepupae, underground			larvae (caterpillars) feed on blossoms and developing pods, then chew into beans		
European corn borer	larvae, in corn residue				second generation larvae bore stems & chew into pods, beans	
stink bug	adults, in & around fields				nymphs and adults suck plant sap, pierce developing pods	

Dry Beans Table 2: Damage checklist to aid in scouting for insects and related pests.

Plant part or timing Type of damage or injury	aphids	European corn borer	grasshoppers	green cloverworm	Mexican bean beetle	plant bug	potato leafhopper	seedcorn maggot	slugs & snails	spider mite	stink bugs	thrips	western bean cutworm	white grubs
Stand (emergence)														
seeds fed-on								x	x					x
gaps in row								x	x					x
wilted or cut plants														x
Leaves														
slimy or shiny trails									x					
scraping of leaf surface					x				x					
skeletonizing between veins					x									
irregular leaf feeding			x	x										
severe defoliation			x	x	x									
generalized leaf yellowing	x					x				x				
yellow leaf margins (hopperburn)							x							
tiny yellow spots (stippling)										x		x		
leaves cupped, crinkled	x					x	x			x		x		
sticky leaves or sooty mold	x													
fine webbing										x				
leaf drop, death							x			x		x		
Stems														
boring into stem		x												
powdery frass		x												
Roots														
root hairs missing														x
pruning of whole roots														x
Pods and beans														
large holes chewed into pod		x	x										x	
small holes chewed into pod		x		x									x	
beans fed-on in pod		x	x										x	
shriveled, aborted beans						x					x			
Other														
virus transmission	x													

Dry Bean Table 3: Life cycle, damage, and pest status of insects in dry beans

Pest status is rated as follows. Rating applies to Michigan.

- Rare: Insect is *unusual, not found in most fields*
- Uncommon: Insect is present in many fields, but *typically not in damaging numbers*
- Occasional: Insect is present in most fields, *sometimes increasing to damaging levels*.
- Important: Insect is present in most fields, *often increasing to damaging levels*; often a target of integrated management or insecticide use by growers.

- Sporadic: Economic outbreaks may occur in certain fields or seasons after *extreme weather* or *mass movement* from south to north early in the season
- Localized: Economic outbreaks may occur in specific locations under *specific agronomic conditions*, for example, in no-till or in late plantings.

Pest (abbreviation)	Life cycle and Number of generations	Description of Damage	Conditions which favor infestation or damage	Pest Status in Michigan
aphids	Summer population is all female. Females give birth to live young and do not mate to reproduce (parthenogenesis). Multiple overlapping generations	• All stages suck plant sap from leaves • Heavy infestation may lead to stunting, curling of leaves, weakening of plants • Aphids also transmit plant viruses	• Drought stress may be made worse by aphids removing plant sap	Uncommon Usually present, but numbers not enough to cause damage
bean leaf beetle	Adults overwinter in leaf litter and wooded field margins. Become active in spring; move into alfalfa, then migrate into beans after first alfalfa cutting. Larvae feed underground on roots. 1-2 generations per year	• Adults defoliate younger plants, leaving small round holes between major leaf veins • Adults feed on and scar developing pods, reducing yield and seed quality	• Adults may move into dry beans if nearby soybean fields were infested in the previous or current season	Uncommon Usually present, but numbers rarely high enough to cause damage
European corn borer (ECB)	Mature larvae overwinter in corn residue and pupate in late spring. Moths emerge in late May-early June and lay eggs in corn and other crops. Two generations in south & central Michigan, the first in June & the second in late July/ early August. One generation in the UP and northern Michigan.	• Older larvae bore into stem, disrupt water flow, weaken stem • Larvae also bore into pods, consume seeds, and contaminate harvested beans	• Nearby non-Bt corn production probably increases local ECB risk	Uncommon Populations suppressed by widespread use of Bt GMO corn
grasshoppers *multiple species*	Eggs overwinter in soil. Nymphs emerge in June. Amount of feeding increases with size. Females lay groups of eggs in the undisturbed soil in late summer. 1 generation per year	• All stages chew on leaves; feeding has a ragged appearance	• Fallow areas and pasture are preferred egg-laying sites • A hot dry summer & fall can lead to a high population the next year	Uncommon Outbreaks rare, usually after a dry season
green cloverworm	Adults lay eggs singly on underside of leaves; larvae feed on foliage	• Small caterpillars scrape leaf tissue while older larvae defoliate plants		Uncommon Usually present, but numbers rarely high enough to cause damage

Pest (abbreviation)	Life cycle and Number of generations	Description of Damage	Conditions which favor infestation or damage	Pest Status in Michigan
Mexican bean beetle	Adults overwinter in crop debris, woodlots, etc. Adults move into dry beans in early summer and lay eggs. Larvae mature in 3-4 weeks, pupating on leaf surface. Adults emerge in late July into August, lay eggs for a second generation. Second generation larvae feed, pupate in late August, and new adults overwinter.	• Larvae and adults strip the leaf surface between the veins on the underside of leaves, resulting in windowpane damage or a skeletonized (lacy) appearance. Time frame: mid-July into August. • Pod feeding is rare	• A mild winter increases survival • Planting adjacent to fields with high populations the previous year • Early-planting (adults attracted to these fields)	Uncommon and Localized
potato leafhopper (PLH)	Adults are carried into Michigan from the south on weather fronts in May/early June. Females lay eggs inside stems. Nymphs hatch in 7-10 days, begin feeding immediately, and reach adult stage in 2-3 weeks. Multiple overlapping generations	• Adults and nymphs lacerate and suck on leaves and stems, damaging cells and blocking vascular tissue; the classic symptom of feeding is tip yellowing or 'hopper burn' • Other symptoms include stunting and curling of leaves and poor pod fill	• PLH damage is worse under dry conditions, and leafhopper survival is probably better too	Sporadic *later in season*: Important, if populations become well-established
seedcorn maggot (SCM)	SCM overwinters as pupae in the soil. Adult flies emerge in early spring and are attracted to lay eggs in disturbed soil with decaying organic matter. Multiple generations	• Tiny larvae (maggots) feed on germinating seed; may cause variable emergence, stand loss, and delayed development	• Cool wet conditions which delay germination • Tillage of fields with high organic matter from a decaying green cover crop, or weeds, or fresh manure	Sporadic and Localized Depends on presence of fresh organic matter and cool, wet conditions
slugs & snails	Slugs overwinter as both eggs & adults; females deposit eggs in soil; these hatch in about one month. Multiple overlapping generations	• Feeding on cotyledons & lower leaves; feeding usually occurs at night • Substantial defoliation can be tolerated in pre-bloom dry beans, but if the growing point is killed, stands can be significantly reduced	• Planting into heavy crop residue • Cool, wet soils which delay germination • Poorly closed furrows (slug highways)	Localized Depends on residue and cool conditions. Dry beans are usually planted after slug risk is past.
spider mite	Adult females overwinter in field borders and sheltered areas. In spring, they move to new growth, and lay eggs. Mites spread from field to field by crawling or blowing in the wind. Multiple overlapping generations	• Adults & nymphs pierce individual plant cells, resulting in tiny yellow spots called stippling • Webbing is a sign of a heavy infestation • Severe damage results in leaf yellowing, death, water loss	• Prolonged hot, dry weather favors outbreaks and enhances the impact of feeding • Infestations often start on dusty edges of fields	Sporadic Outbreaks occur in hot, dry seasons
stink bug *several species including green, onespotted, & the brown marmorated*	Adults overwinter in protected areas. Weeds and early crops like wheat are fed on and colonized first. Stink bug eggs, laid in small clusters, often sport a small 'crown'. Nymphs and adults live and feed in the crop together. Note - some stink bug species are beneficial predators of other insects like caterpillars	• Adults and nymphs feed by injecting salivary enzymes into plants and sucking up plant juices • Feeding on pods can result in aborted or shriveled beans	• May move into dry beans as adjacent wheat fields dry down	Uncommon Numbers rarely high enough to cause damage
tarnished plant bug (TPB)	Adults overwinter in residue and on field edges. Weeds and early crops like alfalfa are fed on and colonized first.	• Adults and nymphs suck plant sap. Tarnished plant bug injects a toxic saliva during feeding. • Feeding on pods can result in aborted or shriveled beans	• May move into dry beans from adjacent alfalfa fields that were recently cut	Uncommon Numbers rarely high enough to cause damage

Pest (abbreviation)	Life cycle and Number of generations	Description of Damage	Conditions which favor infestation or damage	Pest Status in Michigan
thrips	Adults and nymphs overwinter in residue. Populations initially build on grasses and in wheat. Note that thrips are an important food source for some of the beneficial insects, such as pirate bugs, that control other pests.	• Nymphs and adults feed with a single mandible, using it to puncture plant cells and slurp up the liquid inside • Punctured cells dry up, resulting in areas of dead cells; under heavy infestation, leaves dry up, curl, or die	• Dry conditions in early summer • May move into dry beans from adjacent wheat fields or grassy borders that are drying down	Uncommon Usually present, but numbers rarely high enough to cause damage
western bean cutworm (WBC)	Overwinter in pre-pupal stage. Adults emerge in mid-late July; females lay eggs in pre-tassel corn and switch to dry beans as corn matures. Larvae feed on pods at night. In early-September, they drop & burrow into soil to over-winter. Areas with sandy soil appear to have deeper and better overwintering. 1 generation per year	• Tiny larvae feed on leaves and then inside blossoms • Larger larvae drop to the ground & stay under residue or in cracks during the day. They climb into the canopy to feed on pods at night	• Areas with sandy soils, where over-wintering survival is higher • Adjacent corn which is no longer attractive for egg laying (ie. past the pretassel stage)	Occasional - Important Montcalm and surrounding counties + the UP are historic hot spots for WBC
white grubs *multiple species*	Mature grubs overwinter under-ground. Adults emerge May-July, depending on species. Eggs laid in soil in the summer. Grubs feed on roots, then move down in soil profile in late fall to overwinter. In spring, grubs feed for a period, then pupate. 1 generation per year except June beetle, which has a 2-3 year life cycle	• Larvae (grubs) prune root hairs and sometimes whole roots, causing wilting, water and nutrient deficiency, or plant death	• planting into fallow fields or pasture • fields near pasture, home lawns • Fields or parts of fields with sandy soil type	Uncommon

Dry Beans Table 4: Management notes, scouting recommendations, and thresholds.

Pest (abbreviation)	Notes on non-chemical and chemical management	Scouting recommendation	Spray threshold
aphids	• Biological: Predators (such as ladybugs, lacewings, parasitoids) keep populations in check. Under humid conditions, entomopathogenic fungi infect aphids. • Environmental: Heavy rainfall and irrigation can wash off aphids. Adequate moisture reduces feeding stress and increases humidity for infection by pathogens.	Check 100 plants (20 plants x 5 sets)	General guideline: One or more aphid colony (a group of about 30) per plant Rarely justified
bean leaf beetle	• Environment: Extended periods of cold winter temperatures may increase kill of overwintering beetles	Check 100 plants (20 plants x 5 sets)	General guideline: More than 10% of the pods damaged Rarely justified
European corn borer (ECB)	• Biological: Numerous natural enemies kill ECB eggs and larvae. Predators, egg and larval parasitoids, and pathogens are common. • Agronomic: The widespread planting of Bt corn has greatly reduced the European corn borer population in the landscape.	No specific recommendation Note: Trapping can detect large corn borer flights. Michigan moths respond to Z (Iowa) strain pheromone	None
grasshoppers	• Biological: blister beetle larvae and other insects prey on eggs, and 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 sprayed area if hoppers invade from a neighboring field or grassy border	No specific recommendation Have never seen populations high enough to treat in Michigan	General guideline: During flowering & pod fill, 15% overall defoliation by leaf-feeding insects, including hoppers
green cloverworm	• Biological: many natural enemies keep it in check	No specific recommendation Cloverworm can be detected by sweeping or beating plants over a cloth laid between rows	General guideline: During flowering & pod fill, 15% overall defoliation by leaf-feeding insects, including cloverworm
Mexican bean beetle (MBB)	• Biological: natural enemies feed on eggs and larvae • Agronomic: avoid early planting, as overwintered adults colonize these fields first • Environmental: Hot, dry weather and heavy rainfall are both cited as reducing populations	Early-mid July: Scout for # egg masses per meter. Take multiple samples across the field During flowering & pod fill: estimate defoliation	General guideline – 0.5 egg masses per meter/yard or 15% overall defoliation by leaf-feeding insects, including MBB
potato leafhopper (PLH)	• Biological - a naturally occurring fungal pathogen reduces PLH numbers under favorable conditions, usually later in the year • Insecticides: resistance is not an issue with PLH	Check 100 trifoliates from different plants (20 leaves x 5 sets) Count both adults and nymphs	Unifoliate stage: > 0.5 leafhopper per plant Otherwise: > 1 leafhopper per trifoliate leaf
seedcorn maggot (SCM)	• Agronomic: Potential for injury increases in wet, cool springs when seed germinates slower, or when seed is planted into tilled fields where fresh green material (cover crops or weeds) have been worked in. Risk drops after organic matter decomposes. Risk is very low in no-till fields. • Insecticide: Management is preventative, using a seed treatment in tilled fields where weeds and cover crop were recently killed or manure applied.	No specific recommendation	No rescue treatment is available. Consider replanting fields or areas with significant stand loss

Pest (abbreviation)	Notes on non-chemical and chemical management	Scouting recommendation	Spray threshold
slugs & snails	• Biological: Some ground beetle species consume slugs • Agronomic: Tillage and crop rotation reduce corn residue (slug habitat). Avoid planting in wet conditions, as open furrows act as slug highways. • Insecticide: Slugs are not insects, thus soil insecticides and seed treatments have no impact on them. Some studies suggest that seed treatments actually exacerbate slug populations by killing their ground beetle predators.	No specific recommendation Walk fields at night or early morning, turning over residue and looking for slime trials	None established A guess: Consider applying a molluscicide (slug bait) if stand is reduced by 5%
spider mite	• Biological: Under humid conditions, a natural fungal pathogen can infect and wipe out mite populations in a matter of days. Some natural enemies eat mites. • Agronomic: Irrigation mitigates the impact of spider mite feeding and increases humidity for fungal biocontrol, but during a drought, even irrigation isn't enough. • Environmental: Rainfall has a similar effect as irrigation • Insecticide: Insecticide resistance is common in mites. Some insecticides (including most pyrethroids) flare mite populations by killing off natural enemies. Likewise, fungicide applications may disrupt fungal pathogens of mites. Insurance applications of both are discouraged; be cautious about pesticide applications in dry years.	Infestations often start on field edges Look for mites on undersides of leaves using hand lens, or tap leaves over a black piece of paper Webbing is present when populations are high	A guess: Treat when mites appear on >25% of the plants and yellowing is first seen Mites are difficult to control; spraying is often a losing proposition
stink bugs	• Biological: Several parasitoids attack egg masses or bugs	No specific recommendation	None established
tarnished plant bug	• Agronomic: Good weed control reduces alternate hosts for plant bugs	No specific recommendation	General guideline: One bug or more per plant at first flower to green pod stage
thrips	• Biological: Generally kept in check by predators. • Environmental: Rainfall or irrigation reduces populations. • Insecticides: Onion thrips are killed better by pyrethroids than OPs/ carbamates. A caution about spraying: Thrips can be viewed as semi-beneficial, because they are predators of spider mite eggs. Spraying for thrips may contribute to a spider mite outbreak in the future, especially under dry conditions.	Infestations often start on field edges Look for thrips on undersides of leaves using hand lens. Or tap leaves over a white piece of paper or a paper plate	Threshold used in the High Plains (not tested in Michigan): >15 thrips per plant and leaf cupping is present
western bean cutworm	• Biological: many predators consume eggs and larvae; tiny Trichogramma wasps have been seen in the field in Michigan parasitizing egg masses	Sampling beans directly for WBC eggs of larvae is difficult Use bucket-type pheromone traps to detect flight, starting at the end of June. At a cumulative catch of 100-120 moths, scout fields for pod feeding	Action threshold developed In the Great Lakes Region: Treat when >10% of pods are fed-on by WBC larvae
white grubs	• Biological: Some species are attacked by pathogens • Agronomic: If practical, fall plowing of long-standing fallow fields & pasture prior to planting is recommended. Tillage also exposes grubs to mammals and birds. Note: It is important to identify grubs to distinguish annual species from multi-year species of June beetles.	No specific recommendation Grubs tend to be patchy, and in sandy parts of fields Grubs are sometimes detected when plowing in the fall or spring	None established

Dry Beans Table 5: Insecticides registered on dry beans in Michigan for use at planting, with preharvest intervals and precautions

- 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 T-band or in-furrow; see label for PRE and PPI instructions
Bifender FC	(a) 0.17 - 0.34 oz per 1000 ft (= 3.0 - 5.9 oz per acre)				Note: Many of these products can be broadcast soil surface to control black cutworm and armyworm.
Capture 3RIVE3D	(a) 0.19 – 0.46 oz per 1000 ft (= 3.2 - 8 oz per acre)				
Bifenture LFC Capture LFR Sniper LFR	(a) 0.2 - 0.39 oz per 1000 ft (= 3.4 - 6.8 oz per acre)				
bifenthrin + biofungicide *(Bacillus amyloliquefaciens)* Ethos XB	(a) 0.2 - 0.49 oz per 1000 ft (= 3.4 - 8.5 oz per acre)	a		a	• contains a biological fungicide strain for suppression of early season root diseases. • Apply T-band or in-furrow; see label for PRE and PPI instructions
cypermethrin (zeta)					
Mustang	(a) 0.247 oz per 1000 ft (= 4.3 oz per acre)			a	• Apply T band or in-furrow in a minimum of 2-7 gal per acre
Mustang Maxx	(a) 0.23 oz per 1000 ft (= 4 oz per acre)				
iron phosphate					
Sluggo	(a) 0.5 – 1.0 lb per 1000 ft (= 20 - 44 lbs per acre)		a		• Broadcast using a spreader • Apply bait in evening when slugs feed; product works best when the soil is moist

Dry Beans Table 6: Foliar insecticides registered on dry beans in Michigan, with preharvest intervals and precautions.

- 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.
- Acronyms: BLB-bean leaf beetle; ECB-European corn borer; GCW-green cloverworm; MBB-Mexican bean beetle; PLH-potato leafhopper; TPB-tarnished plant bug; WBC-western bean cutworm

Active ingredient Trade Names	**Labelled rate per acre** (unless stated)	**aphids**	**BLB**	**ECB**	**grasshopper**	**GCW**	**MBB**	**PLH**	**spider mite**	**stink bug**	**TPB**	**thrips**	**WBC**	**Pre harvest interval (PHI) in days**	**Precautions and Remark**
abamectin															
Abba Ultra	(a) 4 - 8 oz								a					7	• Ground application recommended (instead of by air), at minimum 10 gal per acre • To avoid the chance of illegal residue, product must be applied with a "non-ionic activator type wetting, spreading or penetrating spray adjuvant" that is approved on dry beans. See label for details
Agri-Mek SC	(a) 1.75 - 3.5 oz														
acephate															
Acephate 90WDG Acephate 90WSP	(a) 4 - 8 oz (b) 8 - 17.6 oz (c) 12.8 - 17.6 oz	b	b	c	a	b	b	b			b	b		14	• Minimum 20 gal per acre (ground) or 2 gal per acre (air) • Do not feed treated vines to livestock • WSP formulation is in water soluble packets
Acephate 90 Prill	(a) 4.4 - 8.9 oz (b) 8.9 - 17.6 oz (c) 13.3 - 17.6 oz														
Acephate 97UP Acephate 97 WDG Orthene 97	(a) 4 - 8 oz (b) 8 - 16 oz (c) 12 - 16 oz														
Bacillus thuringiensis (Bt)															
Agree Biobit HP Dipel ES Javelin Xentari DF	(a) 0.5 - 2.0 lbs (a) 0.5 - 1 lb (a) 1 - 2 pints (a) 0.25 - 1.5 lbs (a) 0.5 - 1.5 lb					a								0	• Larvae must eat treated foliage to be killed, so good coverage is needed • Bt sprays are most effective on small caterpillars • Biobit, Dipel DF, and Xentari can be used on organic beans
bifenazate															
Acramite 4SC	(a) 16-24 oz								a					7	• Apply in minimum of 20 gal per acre (ground) or 7 gal per acre (air) • Max 2 applications per year; 14 days between sprays

Active ingredient Trade Names	**Labelled rate per acre** (unless stated)	**aphids**	**BLB**	**ECB**	**grasshopper**	**GCW**	**MBB**	**PLH**	**spider mite**	**stink bug**	**TPB**	**thrips**	**WBC**	**Pre harvest interval (PHI) in days**	**Precautions and Remark**
bifenthrin Bifen 2AgGold Bifenthrin 2EC Bifenture EC Brigade 2EC Fanfare EC, 2EC, and ES Sniper & Sniper Helios Tundra EC	(a) 1.6 - 6.4 oz (b) 2.1 - 6.4 oz (c) 5.12 - 6.4 oz	b	b	b	b	a b	b	a	c	b	b	b	b	14	• Maximum 0.3 lb/ acre of active ingredient per season • Do not make applications less than 7 days apart • Extremely toxic to bees; See labels for details
bifenthrin + a biofungicide *(Bac. amyloliquefaciens)* Ethos XB	(a) 2.8 - 8.5 oz	a	a	a	a	a	a	a	a	a	a	a	a	14	• Contains a biological fungicide strain - otherwise similar to bifenthrin
bifenthrin + cypermethrin (zeta) Hero Hero EW Steed	(a) 4.0 - 10.3 oz (b) 10.3 oz (a) 4.5 - 11.2 (b) 11.2 oz (c) 3.5 - 4.7 oz	a c	a c	a c	a c	a c	a c	a c	b	a c	b	b c	a c	21	• Do not make applications less than 7 days apart • Max 27.39 oz (Hero), 29.86 (Hero EW) of product per season
bifenthrin + imidacloprid (1:1 ratio) Brigadier Swagger	(a) 3.8 - 5.6 oz (b) 5.6 oz (a) 7.6 - 11.2 oz (b) 11.2 oz	a	b	b	a	b	b	a			a	a		14	• Do not make applications less than 7 days apart • Extremely toxic to bees; See label for details
bifenthrin + imidacloprid (2:1 ratio) Skyraider	(a) 2.1 - 5.6 oz (b) 5.12 - 5.6 oz	a	a	a	a	a	a	a	b	a	a	a	a	14	• Do not make applications less than 7 days apart • Extremely toxic to bees; See label for details
carbaryl Carbaryl 4L Sevin 4F Sevin XLR Plus	(a) 0.5 - 1.0 qt (b) 1.0 qt (c) 1.0 - 1.5 qt		a	c		a	a	b		c	c	b	b	21 beans 14 forage	• Applications interval minimum of 7 days • Application to wet foliage or in periods of high humidity may cause plant injury • "May kill honey bees and other bees in substantial numbers"; do not apply when crop or weeds are in bloom. See labels for additional details
chlorantraniliprole Coragen Prevathon	(a) 2 - 5 oz (b) 3.5 - 7.5 oz (a) 8 - 20 oz (b) 14 - 20 oz			b	a								b	1	• Thorough coverage is important; insects must eat treated foliage for optimum control • See label for specific directions for grasshopper control

Active ingredient Trade Names	**Labelled rate per acre** (unless stated)	**aphids**	**BLB**	**ECB**	**grasshopper**	**GCW**	**MBB**	**PLH**	**spider mite**	**stink bug**	**TPB**	**thrips**	**WBC**	**Pre harvest interval (PHI) in days**	**Precautions and Remark**
chlorantraniliprole + cyhalothrin (lambda) Besiege	(a) 5 - 8 oz (b) 6 - 10 oz (c) 10 oz	b	b	b	b	a	a	b	c	b	b	b	b	21	• Do not graze or harvest vines for forage • For mites, suppression only
cyantraniliprole Exirel	(a) 10.0- 20.5 oz			a										7	• Label lists suppression of potato leafhopper and thrips • See label statement about 'adverse crop response'
cyantraniliprole + abamectin Minecto Pro	(a) 7.5 - 10 oz			a						a				7	• Apply in minimum of 10 gal per acre ground or 5 gal per acre air; ground application recommended for coverage • Label lists suppression of potato leafhopper and thrips • See label statement about 'adverse crop response'
cyfluthrin Baythroid XL Tombstone Tombstone Helios	(a) 0.8 - 1.6 oz (b) 1.6 - 2.4 oz (c) 2.4 - 3.2 oz		c	c	c	c	c	a		b	b		*	7	• Do not feed treated vines or hay to livestock * Western bean cutworm is not on the current labels, but cyfluthrin is labeled for WBC in corn
cyfluthrin + imidacloprid Leverage 360	(a) 2.4 - 2.8 oz	a	a	a	a	a	a	a			a			7	• Label lists suppression of stink bugs at high rate • Do not feed treated vines or hay to livestock
cyhalothrin (gamma) Declare Proaxis	(a) 0.77 - 1.28 oz (b) 1.28 - 1.54 oz (a) 1.92 - 3.30 oz (b) 2.56 - 3.84 oz	b	b	b	b	a	a	b		b	b	b	b	21	• Do not graze or harvest vines for forage
cyhalothrin (lambda) Grizzly Too Lamcap II Province II Warrior w/Zeon Kendo Lambda-Cy Lambda-Cy Ag Lambda Cyhalothrin 1EC LambdaStar Lambda-T Paradigm VC Silencer Willowood Lambda-Cy1EC	(a) 0.96 - 1.60 (b) 1.28 - 1.92 (a) 1.92 - 3.2 (b) 2.56 - 3.84	b	b	b	b	a	a	b		b	b	b	b	21	• Max 7.68 oz / acre per season • Do not graze or harvest vines as forage or hay
cypermethrin (alpha) Fastac EC or CS	(a) 2.7 -3.8 (b) 3.2 - 3.9 oz	b	a	a	b	a	a	a		b	a	b	*	21	• CS formulation is microencapsulated * Western bean cutworm is not on the current labels, but cypermethrin is labeled for WBC in corn

Active ingredient Trade Names	**Labelled rate per acre** (unless stated)	**aphids**	**BLB**	**ECB**	**grasshopper**	**GCW**	**MBB**	**PLH**	**spider mite**	**stink bug**	**TPB**	**thrips**	**WBC**	**Pre harvest interval (PHI) in days**	**Precautions and Remark**
cypermethrin (zeta) Mustang Mustang Maxx	(a) 3.0 - 4.3 oz (b) 3.4 - 4.3 oz (a) 2.72- 4.0 oz (b) 3.2 - 4.0 oz	b	a	a	b	a	a	a		b	a	b	*	21	• Extremely toxic to bees. Do not apply to blooming crops if bees are visiting the field * Western bean cutworm is not on the current labels, but cypermethrin is labeled for WBC in corn
dimethoate Dimate 4E Dimethoate 400 and 4EC	(a) 0.5 - 1.0 pt	a	a		a		a	a	a		a			0	• Max 2 pints/ acre per year; 14-day retreatment interval • Do not feed treated vines • Highly toxic to bees
esfenvalerate Asana XL S-FenvaloStar Zyrate	(a) 2.9 - 5.8 oz (b) 5.8 - 9.6 oz				b	b	a	b					b	21	• Do not feed or graze livestock on treated vines • See label language about grasshopper control • Highly toxic to bees; See label for details
flupyradifurone Sivanto HL Sivanto 200 SL Sivanto Prime	(a) 3.5 - 7.0 oz (a) 7 - 10.5 oz (a) 7 - 14 oz	a						a						7	• Foliar applications have systemic properties; product moves from deposition point to leaf tips and controls insects on underside of leaves
imidacloprid Admire Pro Advise Four Alias 4F Montana 4F Nuprid 4F Max Wrangler Nuprid 2SC Prey 1.6F and Sherpa	(a) 1.2 oz (a) 1.4 oz (a) 2.8 oz (a) 3.5 oz	a						a						7	• Highly toxic to bees; See label for details
indoxacarb Steward	(a) 6.7 - 11.3 oz			a										7	• For ground application use minimum 20 gal per acre
methomyl Annihilate LV Corrida 29SL Lannate LV Nudrin LV	(a) 0.75 - 3 oz (b) 1.5 - 3 oz	b		b			a	a		*	b	b		14	• Kills both eggs and larvae of corn borer. See label for specific on timing • Highly toxic to bees. See label for details * The labels for Lannate list brown marmorated stink bug as a target

Active ingredient Trade Names	**Labelled rate per acre** (unless stated)	**aphids**	**BLB**	**ECB**	**grasshopper**	**GCW**	**MBB**	**PLH**	**spider mite**	**stink bug**	**TPB**	**thrips**	**WBC**	**Pre harvest interval (PHI) in days**	**Precautions and Remark**
methomyl continued Annihilate SP Corrida 90WSP Lannate SP Nudrin SP	 (a) 0.25- 1 oz (b) 0.5 - 1 oz														
methoxyfenozide Intrepid 2F	(a) 8 - 16 oz			a										7	• Apply in minimum of 20 gal per acre (ground) in a full canopy or 10 gal per acre (air) • See label for information on application timing • Endangered species warning on label for applications made in these Michigan counties: Allegan, Monroe, Montcalm, Muskegon, Newaygo, Oceana
naled Dibrom 8E	(a) 1 pint (b) 1.5 pint	a				a		a	a	b	a			1	
pyrethrins Evergreen EC 60-6 PyGanic EC 1.4 II PyGanic Specialty	(a) 2.0 - 12.6 oz (a) 16 - 64 oz (a) 4.5 - 15.6 oz	a	a	a	a	a	a	a		a	a	a	a	0 when sprays dry	• Plant-derived insecticides that knock down insects quickly but have very short residual control. Coverage is critical • Max 10 applications per season, min 3-day spray interval • PyGanic is OMRI listed for use on organic crops; Evergreen does not have OMRI certification because it contains PBO (piperonyl butoxide), a synergist which improves kill • Highly toxic to bees exposed to direct treatment; do not apply on or drift onto blooming crops or weeds
spinosyns **(spinetoram & spinosad)** Entrust Blackhawk Radiant SC Entrust SC Spintor 2SC	 (a) 1 - 2 oz (b) 1.5 - 2 oz (a) 1.7-3.3 oz (b) 2.5 - 3.3 oz (a) 3 - 8 oz (b) 5 - 8 oz (a) 3 - 6 oz (b) 4.5 - 6 oz			a								b		28	• Maximum 12 oz / acre per year • Do not make more than two consecutive applications of products with spinetoram or spinosad • For European corn borer, sprays must target eggs and small larvae; see label for information on application timing • For thrips, control improved by adding an adjuvant; see label for details • Do not feed forage to meat or dairy animals

Active ingredient Trade Names	**Labelled rate per acre** (unless stated)	**aphids**	**BLB**	**ECB**	**grasshopper**	**GCW**	**MBB**	**PLH**	**spider mite**	**stink bug**	**TPB**	**thrips**	**WBC**	**Pre harvest interval (PHI) in days**	**Precautions and Remark**
spirotetramat Movento Movento HL	(a) 4 - 5 oz (a) 2 - 2.5 oz	a												7	• Movento label also lists 'suppression' of spider mites and some species of thrips
sulfoxaflor Transform WG	(a) 0.75-1.0 oz (b) 1.5 - 2.25 oz	a									b			7	• Translaminar product, which moves within the leaf to target sucking pests • Label also lists 'suppression' of thrips and some species of stink bug