MSU-OSU Field Crops Insect Guide: Management of Insects and Spider Mites in Field Corn
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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 **field corn**. 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 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.

Corn Table 1. Timing of damage from common insects and related pests 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	Asiatic garden Euro Chafer				
		Japanese beetle grubs				
		June beetle grubs				
seedcorn maggot	pupae, in soil	larval damage				
wireworm	larvae, in soil	larval damage				
flea beetle	adults, on field edge	adult feeding				
slugs & snails	both eggs and adults, in field	feeding on seedling				
billbug	adults, on field edges	adult feeding	larval feeding - root, crown			
sandhill crane	-----	birds pull out & consume seeds				
black cutworm	Southern USA, migrate north	larval feeding, cutting of plants				
true armyworm	Southern USA, migrate north	larval feeding on foliage				
corn rootworm	eggs, underground		larval root feeding		adult silk clipping	
corn blotch leafminer	adult flies		larvae mine leaf tissue			
grasshoppers (multiple species)	egg clusters, underground			nymphs, then adults, feed on foliage		
European corn borer	5th instar, in crop residue		1st generation larval feeding	2nd generation larval feeding		
Japanese beetle adult	larvae (grub), underground			adult silk clipping		
corn earworm	Southern USA, migrate north				larval feeding in ear	
fall armyworm	Southern USA, migrate north			larval feeding on leaves and in the ear		
western bean cutworm	prepupae, underground			larval feeding in ear		
stink bug	adults, nymphs(?), in & around fields		damage to young corn		kernel damage	
corn leaf aphid	Southern USA, migrate north			multiple generations remove plant sap		
spider mite	adult females, at base of hosts			multiple generations pierce plant cells		
sap or picnic beetles	pupae & adults, crop residue				adult & larval feeding in damaged ears	

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

Plant part or timing Type of damage or injury	aphids	billbug	black cutworm	corn earworm	corn leafminer	corn rootworm larvae	corn rootworm adults	Euro. corn borer	fall armyworm	flea beetle	grasshoppers	white grubs	Japanese beetle adult	sap beetle	seedcorn maggot	slugs & snails	spider mite	stink bug	true armyworm	western bean cutworm	wireworm
Stand (emergence)																					
seeds fed-on															x	x					x
gaps in row			x									x			x	x					x
wilted or cut plants			x																		x
hole thru base of plant			x																		x
seedling top cut-off straight			x																		
Leaf tissue																					
slimy or shiny trails																x					
scraping of top layer of leaf							x			x						x					
leaf mining					x																
shot-, pin-, or round holes								x													
parallel oblong holes		x																x			
small hole in midrib								x													
skeletonized between veins							x						x								
irregular leaf feeding			x	x					x		x								x		
severe defoliation, midrib left											x								x		
large frass pellets				x					x										x		
white powdery frass								x													
stippling (tiny yellow spots)																	x				
brown, ‘crispy’, dead leaves																	x				
sticky; sooty mold	x																				

Plant part or timing Type of damage or injury	aphids	billbug	black cutworm	corn earworm	corn leafminer	corn rootworm larvae	corn rootworm adults	Euro. corn borer	fall armyworm	flea beetle	grasshoppers	white grubs	Japanese beetle adult	sap beetle	seedcorn maggot	slugs & snails	spider mite	stink bug	true armyworm	western bean cutworm	wireworm
webbing																	x				
Tassels																					
fed-on				x																x	
broken								x													
sticky or with sooty mold	x																				
Stalks																					
tunneling into stalk								x													
stalk breakage								x													
lodging, goosenecking						x															
Roots																					
brown tracks, scarring						x															
root hairs missing						x						x									
pruning of whole roots						x						x									
Ear																					
silk clipping				x			x						x							x	
feeding on ear tip				x				x	x					x						x	
scraping of kernel surface								x												x	
tunneling into side									x											x	
tunneling in shank								x													
ear drop								x													
shriveled kernels																		x			
messy frass									x											x	

Corn Table 3: Life cycle, damage, and pest status of insects in field corn.

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

- 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 MI & OH
aphids *Usually corn leaf aphid*	The summer population is female. Females do not mate to reproduce (parthenogenesis); they also give birth to live young. Multiple overlapping generations	• Suck plant sap from leaves, removing water and nutrients • Honeydew secretions may result in sticky leaves and tassels, inhibiting pollen shed or weakening plants	• Drought stress may be amplified by aphids removing plant sap	Uncommon Populations rarely high enough to cause damage
billbug	Adults overwinter along field borders, and emerge during corn planting, usually walking to corn. Eggs laid in soil or in holes chewed in stalk. Larvae feed on crown, roots. Adults emerge between midsummer and fall 1 generation per year	• Adults cut slits in whorl, resulting in extensive tillering • Common symptom-oblong shot-holing as leaves unfurl • Larvae can damage root crown by feeding	• Continuous corn • No or reduced till corn • Field edges • Fields with heavy nutsedge infestation	Rare No recent reports of significant numbers in this region
corn blotch leafminer (CBL)	Flies lay eggs on leaf surface. Larvae (maggots) tunnel between leaf layers, creating mines that widen as larvae grow. Mature larvae chew out of the leaf and drop to the soil to pupate. Several generations per summer	• Females create numerous tiny pinhole feeding wounds • In heavy infestations, entire leaf is mined by multiple larvae • Mined foliage dries up and shrivels, giving the plants a frosted appearance	• Highest populations in Michigan have been observed in muck fields	Rare
corn earworm (CEW)	Major adult flights move north into Michigan and Ohio in July or August. Eggs laid on silks or upper leaves. Larvae (caterpillars) feed on leaves, then on silks and ears. Larvae drop and pupate in soil.	• Larval feeding can damage tassel, silks, kernels in ear • Ear injury is associated w/ invasion of other insects and ear molds that produce mycotoxins	• Late-planted fields which are silking during egg-laying	Uncommon Rarely impacts field corn in the region
corn rootworm (CRW)	Overwinter as eggs in the soil. Eggs hatch in late May-early June. Larvae feed on corn roots for about three weeks; pupate in soil. Adults emerge in early July and feed through the summer. Eggs laid in soil of corn fields, except in areas with the rotation-resistant variant of western corn rootworm, which will lay eggs in soybean and other crops. 1 generation per year	Larvae • root scars, tunneling, severe pruning of nodes of roots • plant stress & yield loss from poor water/ nutrient uptake • lodging and goose necking of plants results in harvest issues Adults: • Scrape leaf surface • Silk-clipping • Feeding on the ear tip	• Continuous corn • late-planted corn (adults attracted to silks for feeding) • Volunteer corn plants in field the previous season • A rotation-resistant variant of western CRW, which lays eggs in soybean and other crops, occurs in SW Michigan	Important *in continuous (corn-after-corn) corn production* Localized *in some first-year corn in SW Michigan*

Pest (abbreviation)	Life cycle and Number of generations	Description of Damage	Conditions which favor infestation or damage	Pest Status in MI & OH
cutworm *Mostly black but also dingy, sandhill, variegated*	Adult moths migrate into north in early spring. Eggs laid on low-growing weeds or crop residue. Small larvae first feed on weeds then shift to corn after herbicide is applied. Larvae hide during the day, & feed at night. Pupation in soil. Several generations per season, but the 1st is most damaging.	• Small larvae create shot-holes in leaves • Older larvae feed on leaves (variegated), tunnel into base of stalk (black) or cut seedlings off (black), reducing stand	• Low, dense weed mats (egg-laying site for females) • No-till fields • Fields with high crop residue • Planting into cover crops or wet areas • Late-planted corn	Sporadic Outbreaks occur after heavy spring flight from the south
European corn borer (ECB)	Mature larvae overwinter in corn residue; pupate late spring. Moths emerge in late May- early June. Females lay egg masses on undersides of corn leaves larvae feed on all above-ground parts of plants. Pupation in stalk (1st gen) or residue (2nd gen). Two generations in south & central Michigan & all of Ohio, the first in June & the second in late July/ early August. One generation in northern Michigan and its upper peninsula	• Small larvae scrape leaf surface (window paning) or chew through whorl, resulting in shot-holing damage • Larger larvae bore into midrib & stalk, disrupting water flow, weakening stalk, or resulting in breakage • Boring of shank can result in ear drop and kernel feeding reduces yield • Ear injury is associated w/ invasion of ear molds that produce mycotoxins; stalk injury associated w/ stalk rot	• No-till fields with corn residue • Areas with a high % of non-Bt corn • Early planted (taller) fields at risk for 1st generation; late-planted fields at risk for 2nd gen. Note: Besides field corn, hosts include sweet corn, snap & dry beans, potato, tomato, peppers	Was important, now occasional Outbreaks in field corn currently suppressed due to wide-spread use of Bt corn
fall armyworm (FAW)	FAW is a tropical species that cannot survive freezing temperatures. Adult moths migrate north, arriving in mid to late season. Eggs laid on corn leaves. Larvae feed in whorl during the day or in the ear. Pupation in soil. 1-3 generations at end of season, if temp is warm enough. Larvae CANNOT overwinter in our area.	• Leaf damage to whorl-stage corn • Kernel feeding (part of the caterpillar complex feeding in the ear)	• Late-planted corn attracts moths for egg-laying • Edge rows may be damaged by larvae marching in from infested grassy edge, pasture, or forages	Uncommon in MI Sporadic in Ohio
flea beetle	Adults overwinter, emerge in the spring. Eggs laid in soil around corn plants. Larvae feed and pupate in soil. Several generations per year	• Adults feed on upper leaf surface, leaving white scraping or scratches. Direct damage rarely a concern. • Infected adults transmit Stewart's wilt bacteria from gut during feeding. Usually not a problem in field corn but causes yield loss in susceptible inbred lines used for seed production.	• Mild winters favor survival of adult beetles, and thus overwintering of Stewart's wilt bacteria in the beetle gut	Uncommon in field corn May be of more concern as a disease vector in seed corn production
grasshoppers *several species*	Eggs overwinter in soil. Nymphs emerge in June. Amount of feeding increases with size. 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	• Fallow areas bordering fields and pasture are preferred egg-laying sites • A hot summer & fall can lead to a high population the following season	Uncommon Outbreaks rare
Japanese beetle adults	Larvae (grubs) feed underground on roots of many hosts. Adults emerge mid-summer, and feed on leaves, silks, and pollen, plus on hundreds of other hosts. Eggs laid in soil in July - September 1 generation per year	• Silk-clipping, similar to rootworm adults; severe clipping can reduce pollination • Feeding skeletonizes leaves but damage isn't economic	• populations often higher on field edges, especially near turf	Uncommon

Pest (abbreviation)	Life cycle and Number of generations	Description of Damage	Conditions which favor infestation or damage	Pest Status in MI & OH
seedcorn maggot (SCM)	Overwinter as pupae in soil. Adult flies emerge in early spring, laying eggs in disturbed soil with decaying organic matter. Larvae (maggots) feed on decaying matter and seeds. Several generations per year, only the first causing crop damage	• Larvae feed on germinating seeds and cause variable emergence, stand loss, and delayed development • Damage often occurs over large part of field	• Cool, wet soil conditions which delay germination • Recent (within 2 weeks) tillage of green organic matter such as cover crops or weeds • Recent application of fresh manure	Localized Occurs under certain field and environmental conditions
sap beetle *= picnic beetle*	Adults overwinter. Eggs deposited on/ near decaying vegetation, including in ears opened by other insects. Larvae feed in ear, and pupate in soil. Several generations per season	• Larvae and adults are secondary pests in ears fed on by other insects, creating additional damage and areas for ear mold infection	• Ears opened and injured by other insects (such as CEW, ECB, WBC) • Cool, wet late season conditions which enhance ear mold growth	Uncommon
slugs & snails	Slugs overwinter as eggs & adults, so both are present at planting. Eggs laid in soil; these hatch in about one month. Multiple overlapping generations	• Feed on seeds, cotyledons, & leaves • Heavy feeding on small corn plants may slow development or reduce stand • Feeding usually occurs at night	• No or reduced-till • Planting into wheat stubble or heavy crop residue • Cool, wet soil conditions which delay germination • Poorly closed furrows act as slug highways	Localized (but increasing) Occurs under certain field conditions
spider mites (two-spotted)	Adults overwinter in field borders and sheltered areas. In spring, adults move to new growth, lay eggs on underside of leaves. Mites spread from field to field by crawling or blowing in the wind. Multiple overlapping generations	• Adults & nymphs pierce individual plant cells, creating tiny yellow spots called stippling • Webbing is a sign on 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 bugs *several species*	Adults and nymphs feed by injecting salivary enzymes into plants and sucking up plant juices	• Feeding in V4-V5 corn creates characteristic pattern of circular holes with yellow margins as the whorl unrolls • In severe case, plants may be twisted, deformed; growing point can die • Feeding on the ear later in season can result in aborted or shriveled kernels	• No-till corn • Rye cover crop or weeds which were killed by herbicide	Uncommon This rating could change as brown marmorated stink bug moves into the region
true armyworm (TAW)	Adult moths migrate into Michigan in early spring. Eggs laid on weedy grasses before corn emerges, and on small grains like wheat. In corn, small larvae first feed on weeds then shift to the crop after herbicide is applied. Larvae on wheat move into neighboring crops, including corn. Larvae pupate in the soil and adults emerge in a week. 2 to 3 generations per year, the 1st generation most damaging	• Larvae feed on leaf margins, sometimes completely defoliating plants, leaving only the midrib • Corn plants usually recover if growing point is not injured, but a severe infestation can defoliate a field in several days	• Reduced tillage • Adjacent small grain fields	Sporadic Outbreaks occur after heavy spring flight from the south

Pest (abbreviation)	Life cycle and Number of generations	Description of Damage	Conditions which favor infestation or damage	Pest Status in MI & OH
western bean cutworm (WBC)	Overwinter in pre-pupal stage. Adults emerge in July; females key in on late whorl & pre-tassel stage corn for egg laying. Larvae feed first on tassel and silks, then on kernels in ear. Feeding ends in early- to mid-September when caterpillars drop and burrow into soil. 1 generation per year	• Larger larvae feed in the ear, usually at the tip, but sometimes directly thru the husk into the side of the ear • In rare, heavy infestations, there can be multiple caterpillars per ear • Feeding damage allows other insects to infest; damaged ears also have an increased risk of ear mold infection and quality reduction from mycotoxins	• Fields in the pre-tassel stage • Areas with sandy soils which increase the overwintering survival of larvae • Areas where both corn and dry beans (an alternate host) are grown	Important and often Localized Corn stage during flight is key to infestation level
white grubs - **Asiatic garden beetle (AGB)**	Mature grubs overwinter in field. Adults emerge in June, move and mate at dusk (come to lights). Females attracted to low growing canopy for egg laying (for ex, a soybean field). Grubs feed on roots from July-fall; move down in soil profile in late fall. 1 generation per year	• Grubs feed on cotyledons and roots, reducing stand and plant uniformity • In severe cases, stand loss has been documented • Adults feed on ornamentals plus some veg & fruit crops; however, feeding on field corn leaves appears to be rare	• Previous crop of soybean, potato, alfalfa, or late season infestations of weeds like marestail • Fields or portions of fields with a sandy (> 80% sand) soil type	Localized Damage currently limited to counties in southern MI and northern OH
white grubs - **European chafer**	Mature grubs overwinter in field. Adults emerge in June, mate at dusk near a landmark (ex, tall tree). Grubs feed on roots from July into fall; move down in soil profile in late fall. 1 generation per year	• Grubs feed on cotyledons and roots, reducing stand and uniformity • Adults do not feed	• Corn following soybeans • Field edges near lawns, golf courses, tree lines • Fields or portions of fields with a sandy (> 80% sand) soil type • Spring populations tend to be higher after a dry summer	Uncommon and Localized *No recent reports of losses from EC grubs in corn*
white grubs - **Japanese beetle (JB)**	Mature grubs overwinter in field. Adults emerge July-August. Eggs laid in soil July-Sept. Grubs feed on root from July-fall; move down in soil profile in late fall. 1 generation per year	• Grubs feed on cotyledons and roots, reducing stand and uniformity • Adults are also a pest of corn (see JB adults)	• Planting into fallow fields or pasture • Fields near pasture, lawns, ornamentals • Spring populations are higher after a wet summer	Uncommon
white grubs - **multiple species of June beetle**	Adults emerge in May/June, move and mate at dusk (come to lights. Eggs laid in groups 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 third summer, grubs pupate underground; adults overwinter in soil until next spring. 1 generation takes three years	• Prune cotyledons prior emergence, reducing stand • Prune root hairs and sometimes whole roots, causing wilting, water and nutrient deficiency, or plant death	• Planting into fallow fields & pasture • Fields near pasture, home lawns, tree borders	Uncommon
wireworm	Wireworms are the immature form of click beetles. They spend up to six years in the immature stage. Overlapping generations	• Feed on newly planted corn seeds & roots • May tunnel straight through the base of seedlings below the soil surface	• Planting into long-standing fallow fields and pasture	Uncommon & Localized Related to field history

Corn Table 4: Management notes, scouting recommendations, and thresholds.

Pest	Notes on non-chemical and chemical management	Scouting recommendation	Spray threshold
aphids	• Biological: Predators (such as ladybugs, lacewings, parasitoids) usually 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 (5 plants x 20 sets)	> 50 aphids per plant on 50% of plants Rarely justified in Michigan or Ohio
billbug	• Agronomic: Crop rotation (adult billbugs are slow and don't move far) and tillage reduce populations. Control of sedges removes an alternate host. • Insecticide: Note that granular soil insecticides, applied at planting for another insect, will control billbug	No specific recommendation	No specific recommendation Have never seen infestations in Michigan in Ohio
corn blotch leafminer	• Biological: Numerous wasp parasitoids attack larvae • Insecticide: Not effective because larvae are protected in leaf mines. Spraying also disrupts parasitism.	None	none Not justified in Michigan or Ohio
corn earworm	• Biological: Several predators attack eggs and larvae • Agronomic: Planting early or on-time avoids egg-laying • Insecticide: Spraying to protect the ear is generally not effective • Seed selection: Some Bt corn hybrids provide control; See Bt trait table for details	None	None Not an economic pest of field corn in Michigan or Ohio
corn rootworm larvae	• Agronomic: Crop rotation is by far the most effective way to control CRW. Control of volunteer corn in the rotational crop is important to achieving larval reduction. • Environmental: Wet conditions during egg hatch usually reduce populations in a field (but this can also negatively impact root growth). Adequate soil moisture and nutrients promote good root growth later in the season, and helps blunt the impact of larval feeding. • Seed selection: Some Bt corn hybrids provide control; See Bt trait table for details	Scout fields for beetles to predict the need for an insecticide or a Bt trait the <u>following season</u>. • In continuous corn: Check 100 plants after adult emergence (20 plants x 5 sets) • In soybean: monitor yellow sticky cards placed just above the canopy across field	In continuous corn- 1 beetle per plant In soybean - > 5 beetles per trap per day in late July thru August
corn rootworm adults	• Agronomic: Crop rotation is by far the most effective way to reduce larval, and thus adult, populations	Check 100 plants (20 plants x 5 sets) for silk clipping by CRW & Japanese beetle	Silks clipped shorter than ½ inch before/ during pollination, <u>and</u> adults are still feeding
cutworm	• Biological: Ground beetles and parasitoids kill larvae • Agronomic: Good weed control and timely cover crop termination prior to planting reduce likelihood of infestation • Insecticide: Rescue (post-planting) treatments are effective and preferred, as populations vary by year & location • Seed selection: Some Bt corn hybrids provide control; see Bt trait table for details	Walk fields to determine % wilted or cut plants Dig around base of plants to confirm cutworm larvae are present Note: Pheromone traps can indicate flight and aid in timing of scouting	> 5% plants cut or damaged
European corn borer	• Biological: Numerous natural enemies: egg and larval parasitoids, and pathogens are common • Agronomic: Early-planted fields are most at risk for 1st generation infestation; late-planted fields are most at risk for 2nd generation infestation. Plowing and shredding of stalks reduce overwintering larval numbers to some extent, but not enough to make a difference in the next season. • Insecticide: Spray timing is critical because larvae eventually tunnel into midribs and stalks, out of reach from sprays.	• 1st Generation: count # of plants (20 plants x 5 sets) with windowpane or shot hole damage; unroll whorls to be sure live larvae are still present.	General guidelines: 1st Generation: > 50% of plants with damage and live larvae are still in whorl

Pest	Notes on non-chemical and chemical management	Scouting recommendation	Spray threshold
European corn borer continued	Percent control is usually higher for applications against 1st generation ECB on whorl stage corn than against 2nd generation larvae in the ear zone. • Seed selection: Many Bt corn hybrids provide excellent ECB control; see Bt trait table for details.	• 2nd Generation: count # of plants (20 plants x 5 sets) with egg masses on undersides of leaves Note: Trapping can aid in timing of scouting. Michigan & Ohio ECBs respond to the Z (= Iowa) strain pheromone	2nd Generation: > 50% of plants with egg masses Economic thresholds varying by expected yield, spray cost, and market price are calculated using worksheets available in extension pubs
fall armyworm	• Biological: Parasitized by several wasp and fly species • Insecticide: Spraying to protect the ear is generally not effective • Seed selection: Some Bt corn hybrids provide control; see Bt trait table for details	Check 100 plants (20 plants x 5 sets) for larvae, feeding, frass	> 50% of plants infested with small (under 1 inch) larvae
flea beetle	• Agronomic: Most corn hybrids are resistant to Stewart's Wilt disease transmitted by flea beetles. Avoid early planting of susceptible inbred lines used in seed production. • Environmental: Cold winters reduce the survival of beetles and thus the incidence of Stewart's Wilt	In seed corn production: Check 100 plants (20 plants x 5 sets) for beetles	On susceptible inbred lines, 5 or more beetles per plant, up to the four-leaf stage
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	General guideline: 5 or more hoppers per plant Have never seen populations high enough to treat in Michigan or Ohio
Japanese beetle adults	• Biological: predation and parasitism by other insects on adult beetles is likely low; birds do feed on adults • Agronomic: adults can move around the landscape, so tillage and other practices in nearby fields ay not have much impact	Check 100 plants (20 plants x 5 sets) for silk clipping by Japanese beetle & CRW	Silks clipped shorter than ½ inch (usually in tandem w/ rootworm adults)
seedcorn maggot (SCM)	• Agronomic: Potential for injury decreases with 1) shallow seeding into warm soil and 2) delaying of planting into herbicide-killed or disced cover crops and weeds until organic matter decomposes. • Agronomic: Problems rarely occur in 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 may not be 100% effective if the maggot population is high. Note that granular soil insecticides, applied at planting for another insect, will help to control SCM.	No specific recommendation	No rescue treatment available; consider replanting fields or areas with significant stand loss
slugs & snails	• Biological: Some ground beetles consume slugs • Agronomic: Fields with a history of slug damage could be planted early, so the crop is further along by the time slug feeding starts. Tillage and crop rotation reduce corn residue (slug habitat). Zone tillage and row cleaners help to dry a band along the row and may quicken crop growth. Avoid planting in wet conditions, as open furrows act as slug highways. • Insecticide: Slugs are not insects, so soil insecticides and seed treatments have no impact on them. Some studies suggest that seed treatments make slug problems worse by killing ground beetle predators.	No specific recommendation Walk fields at night or early morning, turning over residue and looking for slime trails	None established A guess - Consider applying a molluscicide (slug bait) if stand is reduced by 5%

Pest	Notes on non-chemical and chemical management	Scouting recommendation	Spray threshold
spider mites (two-spotted)	• 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. This is one reason that 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: At least a third of plants have mites and leaves Are yellowing Factors to consider: *mite population is still growing *weather forecast remains hot and dry *corn is pollinating *low humidity under the canopy *good coverage is possible
stink bugs	• Agronomic: Proper adjustment of planter to close the furrow, so stink bugs cannot feed on the growing point	No specific recommendation	None established Have never seen populations high enough to treat in Michigan or Ohio
true armyworm	• Biological: Often controlled by predators, parasitoids • Agronomic: Good weed control (especially grassy weeds) and timely cover crop termination prior to planting reduce likelihood of infestation • Insecticide: May be able to limit spray to the field edge if larvae invade from a neighboring field or grassy border • Seed selection: Some Bt corn hybrids provide control; see Bt trait table for details	Check 100 plants (20 plants x 5 sets) for larvae, feeding, frass. Target fields that had a cover crop or heavy weed pressure early. During the day, larvae hide in the whorl, at base of plants, under residue	Seedlings: 10% stand loss Whorl stage: 25% of plants w/ $\geq$2 larvae per whorl, OR 75% of plants w/ 1 larva Treat only if larvae are less than 1.25 inch
western bean cutworm	• Biological: Many predators consume eggs and larvae; Trichogramma parasitoids attack eggs • Seed selection: Only Bt corn hybrids with the Vip3A Bt trait provide effective control of WBC. Corn with all other Bt traits should be managed for WBC like non-Bt corn; see Bt trait table for details • Insecticides: Adding an insecticide to a fungicide spray simply as insurance is discouraged, unless the field is really over threshold for WBC. But if a tank mix is being done anyway, default to the optimal timing for your disease target (ear molds, tar spot, etc). WBC control may not be as good, but fungicides are expensive and proper timing is critical for disease control.	To detect first flight, use pheromone bucket traps starting at end of June. Just after peak flight, check 100 plants (20 plants x 5 sets) weekly for egg masses on leaves and young larvae in the tassel or silks. Target pre-tassel and just-tasseling fields for scouting.	In the Great Lakes Region: 5% of plants with egg masses or small larvae. This is a <u>cumulative</u> threshold (i.e. add % infestation from one week to the next towards the 5% threshold)
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 mammal and bird predation. For Asiatic garden beetle in southern Michigan and northern Ohio, delaying planting may avoid most grub feeding. • Insecticide: Note that granular soil insecticides, applied at planting for another insect, may have some effect on grubs. Seed treatments often have mixed results, especially on Asiatic garden beetle. There are no rescue treatments. Note: it is important to identify grubs to distinguish annual species from species of June beetle, which remain in fields for multiple seasons.	Check 20 one foot x one foot shovel samples in fall or spring. Grubs tend to be patchy, especially on sandy knolls or near tree lines. Grubs may also be detected while plowing in fall or spring, especially when birds follow tillage equipment	<u>June beetle:</u> 1 grub per ft^2 <u>Annual grubs</u> European chafer: 2 grubs per ft^2 Japanese beetle and Asiatic garden: use chafer threshold

Pest	Notes on non-chemical and chemical management	Scouting recommendation	Spray threshold
wireworm	• Agronomic: Depending on species, wireworms remain in the larval stage for 1-5 years, thus they are favored by undisturbed soil. If practical, fall plowing of long-standing fallow fields & pasture prior to planting is recommended. • Insecticide: Note that granular soil insecticides, applied at planting for another insect, will have some effect on wireworms. Seed treatments protect seed, but not seedlings. Rescue treatments are not effective.	Scout target fields for wireworms with 5-10 bait traps (directions online or in extension pubs), 2-3 weeks before planting	At least 1 wireworm per bait trap. Otherwise, consider a soil insecticide or seed treatment in fields coming out of fallow, pasture, alfalfa, or that have a history of wireworm

Corn Table 5: Insecticides registered on field corn in Michigan and Ohio 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.
- Acronym: CRW - Corn rootworm

Active ingredient Trade Names	**Labelled rate(s)** per 1000 feet of row or per acre	**cutworm**	**CRW larvae**	**white grubs**	**seedcorn maggot**	**slugs & snails**	**wireworm**	**Precautions and Remarks**
bifenthrin (granular) Empower2	(a) 3.2 - 8 oz in furrow or 6.4 - 8 oz T-band per 1000 ft (= 3.4 - 8.7 lbs/acre) (b) 8 oz per 1000 ft (= 8.7 lbs/acre)	a	b	a	a		a	• Do not apply as a T-band application, unless you can incorporate granules into top 1 inch of soil using tines or chains • Rootworm rate controls light to moderate larval pressure
bifenthrin (liquid) Bifen 2 Ag Gold Bifenthrin 2EC Bifenture EC Brigade 2EC Discipline 2EC Fanfare EC, 2EC, ES Sniper & Sniper Helios	(a) 0.15 - 0.30 oz per 1000 ft (= 2.6 - 5.2 oz/acre) (b) 0.30 oz per 1000 ft (= 5.12 oz/acre)	a	b	a	a		a	• Apply as a 5-7 inch T-band over the open seed furrow • In-furrow pop-up fertilizer may be applied alone or in tank mixes with bifenthrin; see label for instructions • Some labels say 'Do not apply to soil with >30% crop residue' • See label for separate instructions on pre-plant incorporated (PPI) or pre-emerge applications (PRE) with herbicides Note: Bifenture LFC and Capture LFR labels specifically support a rate of 8.5 oz per acre to control Asiatic garden beetle grubs in Michigan and Ohio
Xpedient Plus V Tundra EC	(a) 0.15 - 0.60 oz per 1000 ft (= 2.6 - 10.24 oz/acre) (b) 0.30 - 0.75 oz per 1000 ft (= 5.2 - 12.8 oz/acre)							
Bifender FC	(a) 0.17 - 0.67 oz per 1000 ft (= 2.9 - 11.6 oz/acre) (b) 0.34 - 0.84 oz per 1000 ft (= 5.9 - 18.2 oz/acre)							
Annex LFR Sniper LFR	(a) 0.20 - 0.39 oz per 1000 ft (= 3.4 - 6.8 oz/acre) (b) 0.39 - 0.49 oz per 1000 ft (= 6.8 - 8.5 oz/acre)							
Bifenture LFC Capture LFR	a) 0.20 - 0.78 oz per 1000 ft (= 3.4 - 13.6 oz/acre) (b) 0.39 - 0.98 oz per 1000 ft (= 6.8 - 17.0 oz/acre)							
Capture 3RIVE3D	(a) 0.23 - 0.92 oz per 1000 ft (= 4 - 16 oz/acre) (b) 0.46 - 0.92 oz per 1000 ft (= 8 - 16 oz/acre)							

Active ingredient Trade Names	**Labelled rate(s)** per 1000 feet of row or per acre	**cutworm**	**CRW larvae**	**white grubs**	**seedcorn maggot**	**slugs & snails**	**wireworm**	**Precautions and Remarks**
bifenthrin + biofungicide *(Bac. amyloliquefaciens)* Ethos XB	a) 0.2 - 0.98 oz per 1000 ft (= 3.4 - 17.0 oz/acre) (b) 0.39 - 0.98 oz per 1000 ft (= 6.8 - 17.0 oz/acre)	a	b	a	a		a	• Contains a biological fungicide strain for suppression of early-season root diseases; otherwise similar to bifenthrin
bifenthrin+ **cypermethrin (zeta)** Hero Hero EW	 (a) 4.0 - 10.3 oz/acre (a) 4.5 - 11.2 oz/acre	a		a	a		a	• Apply in-furrow or as a 3-4 inch T-band for seedcorn maggot, grub, and wireworm control; apply on the soil surface in a 5-7 inch band or broadcast for cutworms • Max 41.2 (Hero) and 44.8 (Hero EW) oz per acre per season for all uses; see label for max use rates for all bifenthrin products combined
chlorethoxyfos **+ bifenthrin** Index At-Plant Liquid Smartchoice HC (Smartbox)	 (a) 0.44 - 0.72 oz (b) 0.65 - 0.72 oz (a) 1.0 - 1.67 oz (b) 1.5 - 1.67 oz	a	b	a	a		a	• Apply in-furrow only (do not apply T-band or other banded application); apply Index in a minimum of 2 gal water per acre • Must be applied with an enclosed tractor cab and a closed handling system, e.g., a 'Dosatron' or modified Raven system for Index or the Smartbox system for Smartchoice • 30-day rotational interval for all crops except corn (anytime) • Index has a special 2ee label for Asiatic garden beetle control in MI and OH
cyfluthrin Baythroid XL Tombstone Tombstone Helios	(a) 2.0 - 2.8 oz per 1000 ft (= 35 - 49 oz/acre)				a		a	• Application may suppress white grubs • Apply in water or in pop-up fertilizer, in open furrow ahead of closing wheel • Do not mix with fertilizers containing zinc • Max 11.2 oz total per acre per year
cyhalothrin (lambda) Kendo LambdaStar Lambda-Cy Lambda-T Lambda Cy 1EC Paradigm VC Silencer Grizzly Too Lamcap II Province II Warrior II	(a) 0.66 oz per 1000 ft (= 11.5 oz/acre) (a) 0.33 oz per 1000 ft (= 5.75 oz/acre)	a	a	a	a		a	• Apply in-furrow, as a T-band, or a 7-inch band behind the press wheel • Max 0.12 lbs of active ingredient per acre per year from at-plant + foliar applications • Do not harvest, graze, or cut treated crop for feed within 21 days of application
iron phosphate Sluggo	(a) 20 - 44 lbs/acre					a		• Product includes a bait to attract slugs • Pellets must be broadcast across field • Apply in evening before slugs are active
metaldehyde Deadline GT Deadline MPs	(a) Maximum 33.3 lbs/ acre (a) Maximum 25 lbs/acre					a		• Products include a bait to attract slugs • GT formulation has uniform prills ideal for blending with dry fertilizer • Apply in evening just before slugs are active, especially after a rain or irrigation • Label has specific application instructions • Note: Fatal to some domestic animals (especially dogs)
permethrin Pounce 1.5G Arctic 3.2EC Permastar Ag Perm-Up 3.2EC	(a) 8 oz per 1000 ft (=8.7 lbs/acre) (a) 0.3 oz per 1000 ft (= 6 oz/acre)	a			a		a	• Apply in-furrow, band, or T-band • Check label for specific instructions for pre-emergence or pre-plant incorporated applications

Active ingredient Trade Names	**Labelled rate(s)** per 1000 feet of row or per acre	**cutworm**	**CRW larvae**	**white grubs**	**seedcorn maggot**	**slugs & snails**	**wireworm**	**Precautions and Remarks**
tebupirimphos + cyfluthrin Aztec 4.67G Defcon 4.67G Aztec HC for SmartBox Aztec HC SmartCartidge	(a) 3 oz per 1000 ft (= 3.27 lbs/acre) (a) 1.5 oz per 1000 ft (= 1.63 lbs/acre)	a	a	a	a		a	• Apply in-furrow, as a T-band, or a 7-inch band behind the press wheel; incorporate as instructed on label • Apply in-furrow or T-band for optimal control of all pests except cutworms. For cutworms, apply as a band or T-band • 30-day rotation for all crops except corn • Will not interact with corn herbicides
tefluthrin Force 6.5G Force 10G Smartbox Force 10G SmartCartidge Force EVO	(a) 1.8 - 2.3 oz /1000 ft (= 2.0 -2.3 lbs) (a) 1.25 - 1.5 oz /1000 ft (= 1.4 - 1.6 lbs/ acre) (a) 0.46 - 0.57 oz per 1000 ft (= 8-10 fl oz/acre)	a	a	a	a		a	• Apply in-furrow (optimal method for all pests except cutworm) or as a T-band • Use highest rate for heavy infestations • Make only one application per year • See label for specific instructions on how to make and incorporate applications of granular formulations at cultivation within 30 days of seedling emergence
terbufos Counter 20G (Lock'N Load, Smartbox, or SmartCartidge)	 (a) 4.5-6 oz per 1000 ft (4.9-6.5 lbs/acre)		a	a	a		a	• Apply in-furrow or as a 7-inch band over the row; max 6.5 lbs per acre per year • If crop debris prevents proper placement of granules, an in-furrow application is recommended; in-furrow applications also reduce run-off from rain • Application also controls flea beetle and corn nematodes, and may suppress cutworm • DO NOT use an ALS-inhibiting herbicide if Counter has been applied at planting

Corn Table 6: Foliar insecticides registered on field corn in Michigan and Ohio, 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.
- Letters under a pest name indicate which rate to use from the previous column. If a letter is not listed, that pest is not on the label.
- Acronyms: CRW - corn rootworm; ECB - European corn borer; WBC - western bean cutworm

Active ingredient Trade Names	**Labelled rate(s)** per acre (unless specified)	**aphids**	**CRW adults**	**cutworm**	**ECB**	**fall armyworm**	**flea beetle**	**grasshoppers**	**Japanese beetle**	**spider mite**	**stink bugs**	**true armyworm**	**WBC**	**Pre-harvest interval (PHI) in days**	**Precautions and Remarks**
***Bacillus thuringiensis* (Bt)** subspecies *aizawai* Agree WG Xentari Insecticide subspecies *kurstaki* BioBit HP Dipel 10G Dipel ES Javelin WG	 (a) 1.0 - 2.0 lbs (a) 0.5 - 2.0 lbs (a) 0.5 - 2.0 lbs (a) 10 lbs in whorl (a) 1.5 - 4.0 pints (a) 0.25 - 1.5 lbs				a	a						a	*	0	• Selective biological insecticide to control caterpillars. Larvae must eat treated foliage to be controlled so good coverage is important. Must be targeted on small (1st - 2nd stage) larvae • All listed here can be used on organic crops, except Dipel ES * Western bean cutworm is on the Dipel ES label Corn earworm (not in this table) is on many Bt labels too
bifenthrin Bifenthrin 2EC Bifenture EC Brigade 2EC Discipline 2EC Fanfare EC, 2EC, & ES Sniper & Sniper Helios Tundra EC Bifender FC	(a) 2.1 - 6.4 oz (b) 5.1 - 6.4 oz (a) 2.4 - 7.4 oz (b) 5.9 - 7.4 oz	a	a	a	a	a	a	a	a	b	a	a	a	30	• Max 0.3 lb per acre active ingredient for all applications • Do not apply as a ULV (ultralow volume) application • Do not apply if heavy rainfall is imminent • Check label for Bee Warning
bifenthrin + biofungicide Ethos XB	(a) 2.8 - 8.5 oz (b) 6.8 - 8.5 oz	a	a	a	a	a	a	a	a	b	a	a	a	30	• Contains a biological fungicide strain *(Bacillus amyloliquefaciens)*; otherwise, similar to bifenthrin
bifenthrin+ cypermethrin (zeta) Hero Hero EW Steed	(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 (a) 2.5 - 3.5 oz (b) 3.5 - 4.7 oz	b	b	a	b	b	a	b	b	c	b	b	a	30 grain 30 graze 60 forage	• Max 41.2 (Hero), 44.8 (Hero EW), or 18.7 (Steed) oz per acre per season for all uses; see label for max use rates for all bifenthrin products combined • Do not apply as a ULV (ultralow volume) application • Do not apply if heavy rainfall is imminent • Spider mite is not listed on the Steed label • Check label for Bee Warning

Active ingredient Trade Names	**Labelled rate(s)** per acre (unless specified)	**aphids**	**CRW adults**	**cutworm**	**ECB**	**fall armyworm**	**flea beetle**	**grasshoppers**	**Japanese beetle**	**spider mite**	**stink bugs**	**true armyworm**	**WBC**	**Pre-harvest interval (PHI) in days**	**Precautions and Remarks**
carbaryl Carbaryl 4L Sevin 4F Sevin XLR Plus	(a) 1 - 2 qts (b) 1.5 - 2 qts (c) 2 qts		a	c	b	a	a		a			a	c	14 silage 14 graze 48 grain	• Max 8 quarts per acre and 4 applications per year • REI = 24 hours. Exception: REI of 21 days for workers detasseling seed corn • Check label for Bee Warning
chlorantraniliprole Coragen Prevathon	(a) 3.5 - 5.0 oz (a) 14 - 20 oz				a	a						a	a	14 grain 1 seed	• Do not make more than 2 sequential applications
chlorantraniliprole + lambda-cyhalothrin Besiege	(a) 5 - 10 oz (b) 6 - 10 oz		b	a	b	b	b	b	b		b	b	a	21	• Max 31 oz per acre per year • Minimum 7 days between applications • Use higher rates for heavier infestations • Check labels for specifics on max application rates of products containing gamma & lambda cyhalothrin
cyfluthrin or beta cyfluthrin Baythroid XL Tombstone Tombstone Helios	(a) 0.8 - 1.6 oz (b) 1.6 - 2.8 oz (c) 2.8 oz		b	a	b	c	a	c	b		b	b	b	21 grain 21 fodder 0 forage	• Max 2.8 oz per acre allowed per 7-day interval • Max 11.2 oz per acre and 4 applications per year • Check label for Bee Warning
cyhalothrin (gamma) Declare Proaxis	(a) 1.0 - 1.5 oz (b) 1.5 oz (a) 1.92 - 3.2 oz (b) 2.56 - 3.84 oz	b	b	a	b	b	b	b	b		b	b	a	21 grain 21 silage	• Max 0.38 (Declare) or 0.96 (Proaxis) pints per acre. • Bee Warning: Highly toxic to bees. Do not apply to pollinating corn or drift to flowering weeds if bees are visiting field. • Check labels for specifics on max application rates of products containing gamma & lambda-cyhalothrin
cyhalothrin (lambda) Kendo LambdaStar Lambda-Cy Lambda-T Lambda Cyhalothrin 1EC Paradigm VC Silencer Grizzly Too Lamcap II Province II Warrior II	(a) 1.92 - 3.20 oz (b) 2.56 - 3.84 oz (a) 0.96 - 1.60 oz (b) 1.28 - 1.92 oz		b	a	b	b	b	b	b		b	b	a	21	• Max 0.12 lbs of active ingredient per acre per year from at-plant + foliar applications • For armyworm, only small caterpillars (1st & 2nd instars) are controlled • Check labels for specifics on max application rates of products containing gamma & lambda cyhalothrin • Check label for Bee Warning

Active ingredient Trade Names	**Labelled rate(s)** per acre (unless specified)	**aphids**	**CRW adults**	**cutworm**	**ECB**	**fall armyworm**	**flea beetle**	**grasshoppers**	**Japanese beetle**	**spider mite**	**stink bugs**	**true armyworm**	**WBC**	**Pre-harvest interval (PHI) in days**	**Precautions and Remarks**
cypermethrin (alpha) Fastac CS Fastac EC	(a) 1.3 - 2.8 oz (b) 1.8 - 3.8 oz (c) 2.7 - 3.8 oz (d) 3.2 - 3.8 oz	c	c	a	c	d	c	c	c		c	d	b	30 grain 60 forage	• Max 11.4 oz per acre, including both soil and foliar applications. • Do not use other products containing cypermethrin or zeta-cypermethrin during the same year as this product • Check label for Bee Warning
cypermethrin (zeta) Mustang Mustang Maxx	(a) 1.4 - 3.0 oz (b) 1.9 - 4.3 oz (c) 2.9 - 4.3 oz (d) 3.4 - 4.3 oz (a) 1.3 - 2.8 oz (b) 1.8 - 4.0 oz (c) 2.7 - 4.0 oz (d) 3.2 - 4.0 oz	c	c	a	c	d	c	c	c		c	d	b	7	• Max 17.2 (Mustang) or 16 oz (Maxx) per acre • Check label for Bee Warning
deltamethrin Delta Gold	(a) 1.0 - 1.5 oz (b) 1.5 - 1.9 oz	b	b	a	b	b	a	a	b		b	b		12 silage 12 graze 21 grain	• Max 8.1 oz per acre and 5 applications per year • Make applications at least 21 days apart
dimethoate Dimate 4E Dimethoate 4EC & 400	(a) 1 pint	a	a					a						14 silage 28 grain	• Max 1 pint per year • REI = 48 hours. Exception: REI of 4 days for detasseling • Check label for Bee Warning
esfenvalerate Asana XL S-Fenvalostar Zyrate	(a) 2.9 - 5.8 oz (b) 5.8 - 9.6 oz (c) 7.8 - 9.6 oz	b	b	b	c		b	b	b			b	a	21 grain 1 seed	• Check label for Bee Warning
etoxazole Zeal or Zeal WSP Zeal SC	(a) 1 - 3 oz (a) 2 - 6 oz									a				21	• Max 6 oz per acre and 2 applications per year. • Make applications at least 14 days apart • For resistance management, alternate with a different miticide
flupyradifurone Sivanto 200SL Sivanto HL Sivanto Prime	(a) 7.0 - 10.5 oz (a) 3.5 - 7.0 oz (a) 7.0 - 14.0 oz	a												7 forage 21 grain	• Systemic insecticide, effective on sucking pests • Also controls whiteflies
hexythiazox Onager	(a) 10-24 oz									a				30	• Limit of 1 application per year
indoxacarb Steward	(a) 6.0 - 11.3 oz				a	a							a	14 grain 1 forage 1 silage	• Label also lists suppression of stink bugs and Japanese beetle

Active ingredient Trade Names	**Labelled rate(s)** per acre (unless specified)	**aphids**	**CRW adults**	**cutworm**	**ECB**	**fall armyworm**	**flea beetle**	**grasshoppers**	**Japanese beetle**	**spider mite**	**stink bugs**	**true armyworm**	**WBC**	**Pre-harvest interval (PHI) in days**	**Precautions and Remarks**
malathion Malathion 5 and 5EC Fyfanon ULV Ag	(a) 1.5 pints (a) 4-8 oz	a	a					a						7	• Max 2 applications per year • REI = 12 hours. Exception: REI of 3 days for detasseling • ULV formulation be applied by air or ground using specialized equipment; aphids are not listed on the Fyfanon ULV label •
methomyl Annihilate LV Lannate LV Nudrin LV Annihilate SP Corrida 90WSP Lannate SP Nudrin SP	(a) ¾ - 1½ pints (a) ¼ - ½ pints	a	a		a	a	a					a		21 grain 3 forage 21 stover	• Check label for Bee Warning
methoxyfenozide Intrepid 2F	(a) 4 - 16 oz				a							a	a	21	• Max 64 oz per acre per season
permethrin Perm-Up 25DF Pounce 25WP Arctic 3.2EC Permastar Ag Perm-Up 3.2EC	(a) 6.4 - 9.6 oz (b) 3.2 - 6.4 oz (a) 4 - 6 oz (b) 2 - 4 oz		a	a	a	a	a					a	b	30 grain 0 forage	
permethrin (granular) Pounce 1.5G	(a) 6.7 - 10 lbs			a	a	a						a		30 grain 0 forage	• Broadcast by air or with ground equipment, directing granules into the whorl
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 • Highly toxic to bees exposed to direct treatment; do not apply on or drift onto blooming crops or weeds
spinetoram Radiant SC	(a) 3 - 6 oz				a	a						a	a	28 grain 3 forage 1 seed	• Max 36 oz per acre per season • For resistance management, no more than 2 consecutive application of spinetoram or spinosad

Active ingredient Trade Names	**Labelled rate(s)** per acre (unless specified)	**aphids**	**CRW adults**	**cutworm**	**ECB**	**fall armyworm**	**flea beetle**	**grasshoppers**	**Japanese beetle**	**spider mite**	**stink bugs**	**true armyworm**	**WBC**	**Pre-harvest interval (PHI) in days**	**Precautions and Remarks**
spinosad Blackhawk Tracer	(a) 1.67 - 3.3 oz (b) 2.2 - 3.3 oz (a) 1 - 3 oz (b) 2 - 3 oz				a	a						a	b	28 grain 1 seed	• Important to time sprays with egg hatch • PHI for forage is 7 days (Blackhawk) or 3 days (Tracer)
spiromesifen Oberon 2SC	(a) 5.7 - 16 oz									a				5 silage 30 grain	• Max 17 oz per acre and 2 applications per year • Make applications at least 14 days apart • Active against all mite stages, including eggs • Complete coverage is important. Adjuvants may be used to improve coverage
sulfoxaflor Transform WG	(a) 0.75 - 1.5 oz	a												14 grain 7 grazing 7 forage	• Translaminar product, moves in leaf to target sucking pests • "Do not apply product 3 days before bloom, or until after seed set"