

MSU-OSU Field Crops Insect Guide: Management of Insects in Alfalfa and Grass Forage

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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 **alfalfa and grass hay**. 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** and **Table 6**. 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.

Forages Table 1: Timing of damage from common insects in Michigan and Ohio.
Pests are listed from early to late-season. Key species are highlighted in bold text.

Common name	Overwintering stage, location	April / May	June	July	August	Sept
alfalfa weevil	adults, in protected areas	Larval defoliation		(adults present)		
clover root curculio	adults, in protected areas		egg laying	larval feeding on roots		
white grubs	larvae (grubs), underground	damage to stand from root feeding				
true armyworm	Southern USA, migrates north	caterpillars feed on grasses in mixed stands or pasture				
potato leafhopper	Southern USA, migrates north	avg arrival ~20 May	overlapping generations of nymphs and adults suck plant sap from alfalfa leaves and stems			
spittlebug	eggs, on residue	nymphs suck plant sap		adults suck plant sap		
plant bugs	adults or eggs, in protected areas		nymphs and adults suck plant sap from alfalfa leaves and stems			
aphids (usually pea aphid)	eggs?		nymphs and adults suck plant sap from alfalfa leaves and stems			
caterpillars (multiple species)	depends on species		caterpillars feed on leaves of legumes, grass, or both			
grasshoppers (multiple species)	egg clusters, underground			nymphs, then adults, feed on leaves		
blister beetles (multiple species)	larvae, in soil cells			adult beetles feed on alfalfa leaves and blossoms		
fall armyworm	Southern USA, migrate north					
winter cutworm	larvae, under residue				caterpillars defoliate alfalfa late into fall; active in winter	

Forages Table 2: Damage checklist to aid in scouting for insects.

Plant part or timing Type of damage or injury	alfalfa weevil	aphids	blister beetles	caterpillars	clover root curculio	fall armyworm	grasshoppers	plant bug	potato leafhopper	spittlebug	true armyworm	white grubs	winter cutworm
Leaves													
small holes in leaves	x			x		x							
tip feeding	x												
large holes			x	x		x	x						x
irregular, ragged leaf feeding				x		x	x						
skeletonized 'frosted' appearance	x												x
complete defoliation - alfalfa						x							x
complete defoliation - grasses						x					x		
generalized leaf yellowing		x						x					
yellow leaf margins (hopperburn)									x				
red leaf margins									x				
leaves cupped or crinkled		x						x	x				
leaf drop									x				
sticky leaves or sooty mold		x											
spittle masses										x			
webbed, rolled leaves				x									
Roots													
root hairs missing												x	
pruning of whole roots												x	
chewing scars on taproots					x								
chewed furrows on taproots					x								
girdling of the taproot					x								
Stand													
stand thinning or weediness					x							x	
stand loss					x							x	
Other													
reduced forage quality									x				
shorter stand life	x				x				x			x	
cantharidin toxin in cut hay			x										

Forages Table 3: Life cycle, damage, and pest status of insects in alfalfa and grass hay.

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
alfalfa weevil	Adults (and some eggs) overwinter and become active when temps reach 50F (~ 200 degree days). Adults lay eggs in stems. There are 4 larval stages, 80% of the feeding done by the 4 th and last instar. By mid-June, development is complete, and weevils pupate in spun cocoons on the plant or in residue. Adults feed for a few weeks, then go into summer dormancy in protected areas outside the field. They re-emerge to feed for a time in late summer and early fall. One generation per year	<ul style="list-style-type: none"> • Small larvae feed in the folded terminals, chewing small holes. Older larvae feed on leaves throughout the plant • From a distance, heavily skeletonized foliage looks white, like frost damage • Repeated or heavy damage can reduce stand life by 1-2 yrs or lead to weedy stands 	<ul style="list-style-type: none"> • Weevil populations build over time in older stands because adults overwinter nearby 	Occasional Over threshold in some fields in some seasons
aphids <i>usually pea aphid</i>	Assumed overwintering as eggs. Summer population is all female. Females give birth to 12-14 live young per day and do not mate to reproduce (parthenogenesis). Multiple overlapping generations	<ul style="list-style-type: none"> • All stages suck plant sap from stems and leaves • Heavy infestation can lead to stunting, curling of leaves, and weakening of plants 	<ul style="list-style-type: none"> • Nothing specific 	Uncommon Always present, but not enough to cause damage
blister beetle	Eggs are laid in soil. Larvae of most species feed on grasshopper eggs, and thus are 'beneficial' in this sense. Larvae overwinter and adults emerge in spring. The beetles are distinctive with a round head, narrow 'neck', and loose wings that may not cover the abdomen. Multiple species are found in fields in the region.	<ul style="list-style-type: none"> • Body fluid of live and dead beetles has cantharidin, a chemical which blisters the mouth and digestive tract of livestock. Horses are very susceptible & can die after eating contaminated hay. Hay is contaminated when beetles are incorporated into bales at harvest • Cantharidin dose varies by blister beetle species • 	<ul style="list-style-type: none"> • Grasshopper outbreaks (and thus a dry season) often precedes a bad blister beetle year • Beetles may be attracted to, and aggregate on, flowering alfalfa or weeds later in the season 	Uncommon and Sporadic Usually an issue during or after a dry season
caterpillars <i>cloverworm, loopers, earworm</i>	Many species of caterpillars are found in legume forages. Some overwinter in the region, others migrate from the south	<ul style="list-style-type: none"> • Caterpillars feed on leaves and stems; a few species roll or web leaves 	<ul style="list-style-type: none"> • Nothing specific 	Uncommon Always present, but not enough to cause damage

Pest (abbreviation)	Life cycle and Number of generations	Description of Damage	Conditions which favor infestation or damage	Pest Status in MI & OH
clover root curculio	Adults overwinter and become active in early spring. Small larvae feed on root nodules, and larger larvae on lateral and taproot. Pupation is in soil. Adults feed for a few weeks, then go into summer dormancy. They re-emerge to feed for a time in late summer and early fall. One generation per year	<ul style="list-style-type: none"> • Feeding by small larvae on root nodules could reduce N fixation • Larger larvae create scars, tunnel roots, and girdle the taproot. The injury reduces nutrient flow and creates entry points for root pathogens • Damage accumulates each season. May reduce stand life 	<ul style="list-style-type: none"> • Older stands, as injury accumulates • New seedlings near older stands may be killed by beetles moving out of the older stand 	Uncommon and Localized
fall armyworm	FAW is a tropical species that cannot survive freezing temperatures. Adult moths migrate north, arriving mid to late season. Eggs are laid on leaves. Larvae feed up on plants during the day. Pupation in soil. 1-3 generations, if temp is warm enough in August into fall. Larvae CANNOT overwinter in our area.	<ul style="list-style-type: none"> • Larvae prefer grasses but will eat legumes. Feeding starts on leaf margins; all leaves and small stems can be consumed under heavy infestations, leaving non-host weeds as the only vegetation in the field • Mass numbers may move into a field from adjacent crops (corn, wheat), ditches, or turf 	<ul style="list-style-type: none"> • Strong winds from the SW carry moths northward • Warm conditions in late summer into fall can lead to several FAW generations • Grass hay or mixed stands are likely more attractive for egg laying 	Uncommon and Sporadic Late-season outbreak in 2021 was the worst in ~30 years
grasshoppers <i>multiple species</i>	Eggs overwinter in soil. Nymphs emerge in June. Feeding increases with size. Females lay groups of eggs in the undisturbed soil in late summer. 1 generation per year	<ul style="list-style-type: none"> • Adults and nymphs chew on leaves; feeding has a ragged appearance 	<ul style="list-style-type: none"> • Undisturbed forage fields and pasture are preferred egg-laying sites • A dry summer can lead to an outbreak the following year 	Uncommon in alfalfa Sporadic in pasture Usually after a dry season
plant bugs <i>e.g alfalfa plant bug, lygus bug, & fleahopper</i>	Alfalfa plant bugs overwinter as eggs, while Lygus adults overwinter in residue and on field edges. Weeds and early season crops like alfalfa are preferred hosts. Probably one generation	<ul style="list-style-type: none"> • In legume forage, adults and nymphs suck plant sap; leaves may be curled or stunted • In legumes grown for seed, feeding damages blossoms and seeds, reducing germination 	<ul style="list-style-type: none"> • Nothing specific 	Uncommon Always present, but not enough to cause damage in forage fields
potato leafhopper (PLH)	Adults are carried into the region from the south on weather fronts in late May. Females insert eggs in stems. Nymphs hatch in 7-10 days, begin feeding immediately, and reach the winged adult stage in 2-3 weeks. Multiple overlapping generations	<ul style="list-style-type: none"> • 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' (this symptom may be red in some legumes) • Other symptoms include stunting and curling of leaves • Long term impacts are yield and quality loss and shorter stand life 	<ul style="list-style-type: none"> • New seedlings are very vulnerable • PLH damage is worse under dry conditions, and leafhopper survival is probably better as well 	Sporadic <i>later in season:</i> Important, if populations become well established
spittlebug <i>meadow and two-lined</i>	Eggs hatch in spring. Nymphs of Meadow SB feed near the soil surface on forage plants or weeds and move higher as they grow. Two-lined SB, a species moving into the region, feeds on roots or stems near the soil surface for its entire juvenile stage. Nymphs of both species excrete and live in a spittle mass which protects them from predation and drying out. Adult spittlebugs lay eggs in late summer. One generation per year	<ul style="list-style-type: none"> • Adults and nymphs feed on dilute xylem sap moving from the roots into the plant; they must remove a lot of fluid to get nutrients • Early-season feeding by nymphs can result in plant stress, stunting, bunched top growth, and yield loss • Losses of 10-40% reported for first-cutting yield especially if combined with alfalfa weevil damage 	<ul style="list-style-type: none"> • Nymphs are present early in the season, so first cutting alfalfa is usually the most affected stage 	Uncommon

Pest (abbreviation)	Life cycle and Number of generations	Description of Damage	Conditions which favor infestation or damage	Pest Status in MI & OH
true armyworm	<p>Adult moths migrate into the region in early spring. Eggs are laid on grassy weeds or crops, where larvae (caterpillars) feed. Larvae pupate in the soil and adult moths emerge in a week.</p> <p>2 to 3 generations per year</p>	<ul style="list-style-type: none"> • Prefer to feed on the grass portion of mixed stands or in pastures, but will feed on legumes if forced to • Mass numbers may move into a field from adjacent crops (corn, wheat), ditches, or turf 	<ul style="list-style-type: none"> • Nothing specific 	<p>Sporadic</p> <p>Outbreaks occur in years with a heavy spring flight from the south</p>
white grubs <i>multiple species</i>	<p>Adults (scarab beetles) emerge May-July, depending on species. Eggs are laid in the soil in the summer. Grubs feed on organic matter and roots, then move down in soil profile in late fall to overwinter. In spring, annual grub species feed for a period, then pupate. June beetle grubs have a longer life cycle and may continue feeding for several more years.</p>	<ul style="list-style-type: none"> • Larvae (grubs) in general prune roots, causing wilting, deficiencies, or plant death • June beetle and European chafer feed in grass hay or pasture, creating dead areas • Asiatic garden beetle has been found in parts of alfalfa fields with a thin stand 	<ul style="list-style-type: none"> • Populations of many grub species are higher in fields or parts of fields with sandy soil 	<p>Uncommon</p>
winter cutworm <i>The adult moth is called the 'large yellow underwing'</i>	<p>Winter cutworm is a European species which was first recorded in Canada in 1979.</p> <p>Moths lay eggs in the summer. Caterpillars feed on numerous hosts. The cold tolerant larvae feed well into fall and may emerge on sunny winter days (active on a 22°F day in Traverse City MI in 2008). Larvae resume feeding very early in spring. Pupation occurs underground in May.</p> <p>One generation per year</p>	<ul style="list-style-type: none"> • During outbreaks, larvae can defoliate alfalfa stands in fall. In mixed stands, they prefer to feed on alfalfa first • Late-season feeding reduces stubble that traps snow (thus increasing winter injury) and depletes root reserves (reducing spring growth) • New alfalfa seedlings planted with an oat companion crop are attractive to moths for egg laying and may be thinned 	<ul style="list-style-type: none"> • Nothing specific 	<p>Uncommon</p> <p>Michigan was the first state to report economic damage by this insect in forage crops</p>

Forage Table 4: Management notes, scouting recommendations, and thresholds for insect pests of alfalfa and grass hay.

A 15-inch sweep net is a must for alfalfa, especially to monitor weevil and potato leafhopper. A supplier for nets in the Great Lakes region is Great Lakes IPM Inc in Vestaburg MI. Visit <https://www.greatlakesipm.com/>

Pest (abbreviation)	Notes on non-chemical and chemical management	Scouting recommendation	Spray threshold
alfalfa weevil	<ul style="list-style-type: none"> Biological: Multiple egg, larval, and adult parasitoids (some introduced from the weevil's native range in Europe) often provide good, free control. Numerous predators eat weevils and a fungal pathogen kills larvae under humid conditions Agronomic: If alfalfa is within 7-10 days of harvest, early cutting is the preferred way to reduce larval numbers while keeping numerous weevil parasitoids in the system. Check regrowth for survivors. 	<p>A sweep net is useful to detect weevil larvae</p> <p>Starting in early May, walk a pattern in the field & pick 50-100 stems into a sweep net or bucket; target older stands, since weevils overwinter locally</p>	<p>Threshold:</p> <ul style="list-style-type: none"> If it is more than 2 weeks until cutting: 40% of stems with feeding On regrowth, after early cutting: 6-8 larvae per ft²
aphids <i>usually pea aphid</i>	<ul style="list-style-type: none"> Biological: Aphids are attacked by numerous predators (ladybugs, lacewings, syrphid fly larvae) & parasitoids which keep populations in check. Under humid conditions, entomopathogenic fungi wipe out aphids too Host plant resistance: Most alfalfa varieties have some resistance to pea aphid Environmental: Adequate moisture (rainfall or irrigation) reduces feeding stress and increases humidity for infection by fungal pathogens. Pea aphid populations tend to decline in mid-season when temps exceed 85°F. 	<p>Sweep netting can detect aphids colonizing fields</p> <p>Check plant stems for aphids, count # per stem</p>	<p>Guideline for alfalfa x plant height:</p> <ul style="list-style-type: none"> <10 inches: at least 50 aphids per stem Over 10 inches: 100 aphids per stem <p>Spraying rarely justified</p>
blister beetle	<ul style="list-style-type: none"> Agronomic: Beetles often aggregate on blossoms, so cut alfalfa prior to bloom. Crimping forage during harvest can kill beetles, so if they are present, cut forage and give them time to escape before baling. Agronomic: First and second cutting hay has a lower chance of beetle contamination than later cuttings Insecticides: Chemical control is difficult since residue must last thru harvest. Furthermore, dead beetles killed by insecticide may still end up harvested into bales 	<p>No specific recommendation</p> <p>Walk fields prior to harvest to check for aggregations of beetles</p>	<p>No specific recommendation</p>
caterpillars <i>cloverworm, earworm, loopers</i>	<ul style="list-style-type: none"> Biological: many predators feed on caterpillars Agronomic: If alfalfa is within 7-10 days of harvest, early cutting is the preferred way to reduce caterpillar numbers; check regrowth for survivors 	<p>No specific recommendation</p>	<p>No specific recommendation</p> <p>See guidelines for FAW or TAW</p>
fall armyworm (FAW)	<ul style="list-style-type: none"> Biological: Predators and parasitoids kill larvae Agronomic: If alfalfa or hay is within 7-10 days of harvest, early cutting is the preferred to reduce larval numbers; check regrowth for survivors Insecticides: Applications are most effective on small larvae (less than ¾ inch). If caterpillars are invading from an adjacent field, a limited border treatment can save money. Pesticide resistance: Note that pyrethroids may not be very effective on FAW, since it colonizes from the south where it is sprayed in multiple crops. 	<p>No specific recommendation.</p> <p>To detect flight into the region, use bucket pheromone traps starting in mid-July</p> <p>Fall seedings are particularly vulnerable & a priority for scouting</p>	<p>Guideline for small (< ¾ inch) larvae: 2 -3 per square foot</p>
grasshoppers	<ul style="list-style-type: none"> Biological: Blister beetle larvae prey on eggs. Insects, birds, and mammals eat nymphs & adults. Fungal pathogens kill eggs and nymphs under moist, cool conditions. 	<p>No specific recommendation</p>	<p>Guideline for hay or pasture x plant height</p> <ul style="list-style-type: none"> 6 inches: 8 per square yard > 6 inches: 16 per square yard

Pest (abbreviation)	Notes on non-chemical and chemical management	Scouting recommendation	Spray threshold
plant bugs <i>alfalfa plant bug, lygus bug, fleahopper</i>	<ul style="list-style-type: none"> • Agronomic: Adult plant bugs will leave a field after cutting, pushing bugs into neighboring fields of other crops. This can be a problem for a crop like sugar beets or some vegetables, which are susceptible to damage and may need to be monitored 	No specific recommendation	None Spraying is not recommended
potato leafhopper (PLH)	<ul style="list-style-type: none"> • Biological - A naturally occurring fungal pathogen kills PLH numbers under favorable conditions, usually by August • Agronomic: If alfalfa is within 7-10 days of harvest, early cutting is the best way to manage PLH; many eggs and nymphs will die. Check regrowth for survivors, and treat only if over threshold. • Host plant resistance: PLH-resistant glandular haired varieties trap nymphs and repel adults. The level of resistance varies plant by plant but overall, resistant stands can tolerate many more leafhoppers than regular alfalfa • Insecticides: Dynamic thresholds which vary with plant height x spray cost x hay value are available in extension bulletins or online 	Using a sweep net, take 5 sets of 20 sweeps. Count the total # of PLH (adults and nymphs) Hint: Mark the net handle with inches and use it to measure the stand height	Economic threshold for alfalfa, based on #PLH in 100 sweeps: <ul style="list-style-type: none"> • < 3 inch = 20 • 4-7 inch = 50 • 8-11 inch = 100 • > 12 inch = 200 For resistant varieties: <ul style="list-style-type: none"> • New seeding, use the regular threshold • Older stands, use 3x the regular threshold
spittlebug <i>meadow and two-lined</i>	<ul style="list-style-type: none"> • Biological: Spittle masses protect nymphs from predation • Agronomic: Nymphs usually pupate before first cutting, so early cutting may be less of an option for control 	No specific recommendation	Threshold: 1 or more spittle mass per stem
true armyworm (TAW)	<ul style="list-style-type: none"> • Biological: Predators, a tachinid parasitoid, and fungal pathogens all kill armyworm larvae • Agronomic: If alfalfa is within 7-10 days of harvest, early cutting is preferred to reduce larval numbers; check regrowth for survivors • Insecticides: If caterpillars are invading a forage crop from an adjacent field, a limited border treatment can be made 	No specific recommendation Feeding occurs at night or on cloudy days - check for larvae or big frass pellets on the ground	Guideline for mixed stands or pasture: 4 to 6 larvae per ft ² Note: For mixed stands, both alfalfa and grass hay must be on the label
white grubs	<ul style="list-style-type: none"> • Biological: Natural enemies keep grubs in check in most fields. Note: it is important to identify grubs to distinguish annual species like European chafer and Asiatic garden beetle from multiyear species of June beetles	In poor stands, use a shovel to check for grubs and root pruning Grubs tend to be patchy, infesting sandy parts of fields	None established There are no rescue treatments in hay and limited options in pasture
winter cutworm	<ul style="list-style-type: none"> • Biological: During outbreaks, numerous insects, birds, and mammals were recorded to feed on caterpillars • Insecticides: If caterpillars are invading a forage crop from an adjacent field, a limited border treatment can be made 	No specific recommendation	None established Suggest using the guideline for FAW: 2 -3 per square foot

Forages Table 5: Foliar insecticides registered on alfalfa 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.
- 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: An insecticide must be registered on both alfalfa and grass to be used on intentionally-mixed stands.**

Active ingredient Trade Names	Labelled rate per acre (unless stated)	alfalfa weevil	aphids	blister beetle	caterpillars	fall armyworm	grasshoppers	plant bugs	potato leafhopper	spittlebug	true armyworm	winter cutworm	Pre harvest interval (PHI) in days	Precautions and Remarks
<i>Bacillus thuringiensis (Bt)</i> Agree WG Biobit HP Dipel ES Javelin WG Xentari	(a) 1.0 - 2.0 lbs (a) 0.5 - 2.0 lbs (a) 1.0 - 4.0 lbs (a) 0.25 - 1.5 lbs (a) 0.5 - 2.0 lbs				a	a					a		0	<ul style="list-style-type: none"> • Labeled for alfalfa, clover, many nongrass forage crops • Biological insecticides that must be eaten to kill; coverage important. Applications must be made when larvae are small • Check labels for specific caterpillars • Some products can be used in organic production
carbaryl Carbaryl 4L Sevin 4F Sevin XLR Plus	(a) 0.5 - 1.0 quart (b) 1.0 quart (c) 1.0 - 1.5 quart (d) 1.5 quart	d		a	c	c		c	b		c	c	7 harvest & grazing	<ul style="list-style-type: none"> • Labeled for “alfalfa, clover, birdsfoot trefoil” • On dense growth apply in 25-40 gal water for good coverage • Max 1.5 quarts per cutting • May temporarily bleach tender foliage • Bee caution: Do not apply to blooming crops or weeds
chlorantraniliprole Coragen Prevathon Vantacor	(a) 3.5 - 7.5 oz (b) 2.0 - 5.0 oz (a) 14.0 - 20.0 oz (b) 8.0 - 20.0 oz (a) 1.2 - 2.5 oz (b) 0.7 - 1.7 oz				a	a	b				a		0	<ul style="list-style-type: none"> • Labeled for “non-grass animal feeds” including alfalfa • Max 1 application per cutting • See Prevathon label for specific adjuvants and spray timings related to grasshopper control
chlorantraniliprole + cyhalothrin (lambda) Besiege	(a) 5.0 - 8.0 oz (b) 6.0 - 10.0 oz	b	b	b	a b	b	b	b	a	b	b	a	1 forage 7 dry hay	<ul style="list-style-type: none"> • Labeled for alfalfa • Max 1 application per cutting • Pest note: Check labels for specific rates x caterpillar species • Spray when bees are not foraging (early morning or evening)

Active ingredient Trade Names	Labelled rate per acre (unless stated)	alfalfa weevil	aphids	blister beetle	caterpillars	fall armyworm	grasshoppers	plant bugs	potato leafhopper	spittlebug	true armyworm	winter cutworm	Pre harvest interval (PHI) in days	Precautions and Remarks
cyfluthrin Baythroid XL Tombstone Tombstone Helios	(a) 0.8 - 1.6 oz (b) 1.6 - 2.8 oz (c) 2.0 - 2.8 oz	b			a b	b	c	b	a	a	b	a	7 grazing harvest	<ul style="list-style-type: none"> Labeled for alfalfa (for mixed stands, see Table 6) Max 5.6 oz per cutting Pest note: Check labels for specific rates x caterpillar species Fall armyworm = control of 1st & 2nd instars only Helios formulation has UV protection for extended residual
cyhalothrin (gamma) Declare Proaxis	(a) 0.77-1.28 oz (b) 1.02 - 1.54 oz (a) 1.92 - 3.20 oz (b) 2.56 - 3.84 oz	b	b	b	a b	b	b	b	a	b	b	a	1 forage 7 hay	<ul style="list-style-type: none"> Labeled for alfalfa (pure stands) Pest note: Check labels for specific rates x caterpillar species Spray when bees are not foraging (early morning or evening)
cyhalothrin (lambda) Grizzly Too Kendo 22.8CS Lamcap II Province II Warrior w/Zeon Tech. Grizzly Z Kendo Lambda Cyhalothrin 1EC Lambda-Cy & Lambda-Cy Ag LambdaStar Lambda-T Paradigm VC Silencer Willowood Lambda-Cy1EC	(a) 0.96 - 1.60 oz (b) 1.28 - 1.92 oz (a) 1.92 - 3.20 oz (b) 2.56 - 3.84 oz	b	b	b	a b	b	b	b	a	b	b	a	1 forage 7 hay	<ul style="list-style-type: none"> Labeled for alfalfa (pure stands) only Spray when bees are not foraging (early morning or evening) Fall armyworm: some labels indicate control of 1st & 2nd instars only
cypermethrin (alpha) Fastac EC or CS	(a) 2.2 - 3.8 oz (b) 2.8 - 3.8 oz	a	a		a	b	b	b	a	a	b	a	3	<ul style="list-style-type: none"> Labeled for alfalfa (not labeled for grasses) Max 3.8 oz per cutting
cypermethrin (zeta) Mustang Mustang Maxx	(a) 2.4 - 4.3 oz (b) 3.0 - 4.3 oz (a) 2.24 - 4.0 oz (b) 2.8 - 4.0 oz	a	a		a	b	b	b	a	a	b	a	3	<ul style="list-style-type: none"> Labeled for alfalfa and "nongrass animal feeds" like clover, trefoil, lupine, etc. Max 8.0 oz (Mustang Maxx) or 8.6 oz (Mustang) per cutting

Active ingredient Trade Names	Labelled rate per acre (unless stated)	alfalfa weevil	aphids	blister beetle	caterpillars	fall armyworm	grasshoppers	plant bugs	potato leafhopper	spittlebug	true armyworm	winter cutworm	Pre harvest interval (PHI) in days	Precautions and Remarks
dimethoate Dimate 4E Dimethoate 400 and 4EC	(a) 0.5 - 1.0 pint		a				a	a	a				10	<ul style="list-style-type: none"> Labeled for alfalfa (not labeled for grasses) Max one application per cutting Highly toxic to bees. Do not apply if bees are visiting the treated area when crop or weeds are in bloom
flupyradifurone Sivanto HL Sivanto 200 SL Sivanto Prime	(a) 3.5 - 7.0 (a) 7.0 - 10.5 oz (a) 7.0 - 14.0 oz		a						a				7	<ul style="list-style-type: none"> Labeled for alfalfa (not labeled for grasses) Systemic insecticide, effective on sucking pests Max two applications per year
indoxacarb Steward	(a) 4.6 - 11.3 oz (b) 6.7 - 11.3 oz	b			b		a						7	<ul style="list-style-type: none"> Labeled for alfalfa Max 11.3 oz per cutting
methomyl Annihilate LV Lannate LV Nudrin LV Annihilate SP Corrida90WSP Lannate SP Nudrin SP	(a) 1.5 - 3.0 lbs (b) 3 lbs (a) 0.5 - 1.0 lb (b) 1 lb	b	a		a	a		a			a		7	<ul style="list-style-type: none"> Labeled for alfalfa
methoxyfenozide Intrepid 2F	(a) 4 - 8 oz				a	a					a		0 grazing 3 hay	<ul style="list-style-type: none"> Labeled for non-grass forages (alfalfa, clover, lupin, etc.) Max 1 application per cutting and 32 oz per year Must begin applications at first sign of feeding damage
permethrin Perm-Up 25DF Pounce 25WP Arctic 3.2 PermaStar AG Perm-Up 3.2EC	(a) 3.2 - 12.8 oz (b) 6.4 - 12.8 oz (a) 2 - 8 oz (b) 4 - 8 oz	b	a		a	a		b	b	b		a	0 or 14 see remarks on label	<ul style="list-style-type: none"> Labeled for alfalfa. Do not apply to mixed stands with grasses or other legumes Spray when bees are not foraging (early morning or evening) PHI is 0 days at rates below 0.1 lb active ingredient [Ambush, Perm-Up25DF, & Pounce = 6.4 oz; Arctic, PermaStar & Perm-Up 3.2EC = 4oz] and 14 days above 0.1 lb
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	<ul style="list-style-type: none"> 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

Active ingredient Trade Names	Labelled rate per acre (unless stated)	alfalfa weevil	aphids	blister beetle	caterpillars	fall armyworm	grasshoppers	plant bugs	potato leafhopper	spittlebug	true armyworm	winter cutworm	Pre harvest interval (PHI) in days	Precautions and Remarks
sulfoxaflor Transform WG	(a) 0.75- 1.0 oz (b) 1.5 - 2.75 oz		a					b					7	<ul style="list-style-type: none"> • Labeled for alfalfa. Translaminar product, moves within leaf to target sucking pests • Max 2 applications per cutting

Forages Table 6: Foliar insecticides registered on pasture and grass hay 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.
- 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: An insecticide must be registered on both alfalfa and grasses to be used on intentionally-mixed stands.**

Active ingredient Trade Names	Labelled rate per acre (unless stated)	caterpillars	fall armyworm	grasshoppers	spittlebug	true armyworm	white grubs	winter cutworm	Pre harvest interval (PHI) in days	Precautions and Remarks
<i>Bacillus thuringiensis (Bt)</i> Agree WG Biobit HP Javelin WG Xentari	(a) 1.0 - 2.0 lbs (a) 0.5 - 2.0 lbs (a) 0.25 - 1.5 lbs (a) 0.5 - 2.0 lbs	a				a			0	<ul style="list-style-type: none"> • Labeled for grass forage, fodder, hay • Biological insecticides that must be eaten to kill; coverage important. Applications must be made when larvae are small • Check labels for specific caterpillars • Can be used in organic production
carbaryl Carbaryl 4L Sevin 4F Sevin XLR Plus	(a) 1.0 - 1.5 quart	a	a			a			14 grazing 14 harvest	<ul style="list-style-type: none"> • Labeled for pastures and grasses grown for forage, fodder, and hay • Max 3 quarts (2 applications) per year • Bee caution: Do Not apply to blooming crops or weeds
chlorantraniliprole Coragen Prevathon Vantacor	(a) 3.5 - 7.5 oz (b) 2.0 - 5.0 oz (a) 14.0 - 20.0 oz (b) 8.0 - 20.0 oz (a) 1.2 - 2.5 oz (b) 0.7 - 1.7 oz	a	a	b		a			0	<ul style="list-style-type: none"> • Labeled for "grass forage, fodder, and hay... that will be fed on or grazed by livestock", and pasture. Teff is also on the label • See Prevathon label for specific adjuvants and spray timings for grasshopper control
chlorantraniliprole + cyhalothrin Besiege	(a) 5.0 - 8.0 oz (b) 6.0 - 10.0 oz	b	b	b	b	b		a	0 grazing 7 harvest	<ul style="list-style-type: none"> • Labeled for pasture and "grass grown for hay or silage"
cyfluthrin Baythroid XL Tombstone Tombstone Helios	(a) 1.6 - 1.9 oz (b) 2.6 - 2.8 oz	a b	b	b	a	a		a	0 grass 7 mixed stands	<ul style="list-style-type: none"> • Labeled for grass, "grass for hay", "grass in mixed stands with alfalfa" • Pest note: Check labels for specific rate x caterpillar species • Fall armyworm = control of 1st & 2nd instars only • Helios formulation has UV protection for extended residual

Active ingredient Trade Names	Labelled rate per acre (unless stated)	caterpillars	fall armyworm	grasshoppers	spittlebug	true armyworm	white grubs	winter cutworm	Pre harvest interval (PHI) in days	Precautions and Remarks
cyhalothrin (gamma) Declare	(a) 0.77-1.28 oz (b) 1.02 - 1.54 oz	a b	b	b	b	b		a	0 grazing & forage 7 dry hay	<ul style="list-style-type: none"> Labeled for pasture, "grass grown for hay or silage"
cyhalothrin (lambda) Warrior w/Zeon Tech. Grizzly Too Kendo 22.8CS Lamcap II Province II Grizzly Z Kendo Lambda Cyhalothrin 1EC Lambda-Cy Lambda-Cy Ag LambdaStar Lambda-T Paradigm VC Silencer Willowood Lambda-Cy1EC	(a) 0.96 - 1.60 oz (b) 1.28 - 1.92 oz (a) 1.92 - 3.20 oz (b) 2.56 - 3.84 oz	b	b	b	b	b		a	0 grazing & forage 7 dry hay	<ul style="list-style-type: none"> Labeled for pasture, "grass grown for hay or silage" Max 1.92 oz per cutting and 5.76 oz per season
cypermethrin (zeta) Mustang Mustang Maxx	(a) 2.4 - 4.3 oz (b) 3.0 - 4.3 oz (a) 2.24 - 4.0 oz (b) 2.8 - 4.0 oz	a	b	b	a	b		a	0 hay & forage	<ul style="list-style-type: none"> Labeled for pasture, grass forage and hay Max 4.0 oz (Mustang Maxx) or 4.3 oz (Mustang) per cutting
methoxyfenozide Intrepid 2F	(a) 4 - 8 oz		a			a			0 grazing 7 hay	<ul style="list-style-type: none"> Labeled for grass forage, fodder, and hay Max 1 application per cutting and 32 oz per year Must begin applications at first sign of feeding damage
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	0 when sprays dry	<ul style="list-style-type: none"> 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
spinosad Blackhawk Tracer	(a) 1.1 - 2.2 oz (a) 1.0 - 2.0 oz	a	a			a		a	0 forage 3 hay	<ul style="list-style-type: none"> Labeled for pastures, grass crops Must target egg hatch and small larvae