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PEST MANAGEMENT GUIDE for FIELD CROPS INSECTS: Wheat section

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

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

See Table 1 to cross reference active ingredients x insecticide.

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

Compare PHIs between products

A few of the important statements on the label

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

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

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

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

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

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

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How to Use this Guide

This publication is set up as a series of stand-alone tables with information on insect biology, damage, management recommendations, and insecticides registered in Michigan and Ohio on **wheat and other small grains.** 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 both Michigan and Ohio (except where noted) on the crop are listed in **Table 5.** Active ingredients (AI) are listed alphabetically in column 1. All products with the same active ingredient are grouped together under each AI for easy comparison or substitution of one product for another. Label rates and pests are listed in columns 2 and 3. A letter under a pest indicates that a particular insect is on the label (i.e., the label claims control of that insect). The letter corresponds to an application rate in column 2. Some insecticides are applied at a single rate for all insects (‘a’), while others vary (‘a’, ‘b’, ‘c’). The final columns in the table list the preharvest interval (PHI) in days and notes on application - for example bee toxicity warnings, minimum recommended spray volumes, or other restrictions.

Table 1: Timing of damage from insect pests of wheat 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 (in particular, European chafer)	larvae (grubs), in soil	grubs feed on roots			grubs can destroy new stands by feeding on roots (Euro chafer will feed into late October)	
wheat curl mite	nymphs & adults, on hosts in and around fields	Mites suck plant juices from leaves, primarily on new growth				Infest new stands. May spread viruses
cereal leaf beetle	adults, in protected areas near fields	larvae feed on leaves		adults feed on leaves		
true armyworm	Southern USA, migrate north	larvae feed on leaves and may clip heads after they form				
aphids (multiple species)	Southern USA, migrates north	suck plant sap (on fall planted grain)		suck plant sap (on spring planted grain)		BYDV spread (fall plantings)
Hessian fly	puparia on plants	larvae feed on lower stem				larvae feed on seedlings
grass sawfly	pupae, underground		caterpillars feed on wheat stems			
grasshoppers (multiple species)	egg clusters, underground			nymphs, then adults, defoliate plants		
fall armyworm	Southern USA, migrate north				larvae feed on leaves and strip plants under high infestations	

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

Plant part or timing Type of damage or injury	aphids	cereal leaf beetle	fall armyworm	grasshoppers	grass sawfly	Hessian fly	true armyworm	wheat curl mite	white grubs
Stand (emergence)									
wilted or stunted plants									x
gaps in row									x
fewer, or dead, tillers						x			x
widespread stand loss or thinning			x						x
Roots									
root hairs missing									x
pruning of whole roots									x
Leaf tissue									
Scraping of the leaf surface		x							
skeletonizing		x							
irregular leaf feeding			x	x	x		x		
severe defoliation			x	x			x		
stems stripped of all leaves			x				x		
leaf edges curled inward								x	
new leaf trapped in previous leaf								x	
leaf yellowing from feeding	x								
leaf yellowing, reddening from virus	x							x	
leaves dark bluish-green						x			
field appears whitish or 'frosted'		x							
sticky leaves or head from honeydew	x								
Stem									
short internodes and stems						x			
stunting of plants						x			
small lengths of cut stems on ground					x				
stem breakage, lodging						x			
Head									
awns clipped off							x		
heads clipped off					x		x		
Other									
barley yellow dwarf (BYDV) transmission	x								
wheat streak mosaic transmission								x	
large square frass pellets on ground			x				x		
numerous stem segments on ground					x				

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

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

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

Pest (abbreviation)	Life cycle and Number of generations	Description of Damage	Conditions which favor infestation or damage	Pest Status in MI & OH
aphids *multiple species: English grain aphid, bird cherry-oat aphid, corn leaf aphid, and greenbug*	English grain & corn leaf aphids probably move from the south, but bird cherry-oat aphid may be able to overwinter locally. The summer population is all female. Females do not mate to reproduce and give birth to multiple live nymphs per day. Multiple overlapping generations	• All stages suck plant sap from stems, leaves, and the head, removing water and nutrients • Heavy infestations are rare, but may stress plants and coat leaves and heads in sticky honeydew • Grain aphids, especially the bird cherry-oat aphid, transmit barley yellow dwarf virus. In winter wheat, infection is more serious if it occurs in fall	• A warm fall can extend aphid activity and result in more BYDV transmission to winter wheat	Occasional
cereal leaf beetle *Historic note: CLB was first found in the USA in 1962 in Berrien Co. Michigan*	The handsome blue and red adults overwinter in tree lines, wooded areas, and leaf litter near last year's wheat fields. Beetles colonize small grains in the early spring, laying eggs on leaves. The slug-like larvae feed by scraping the leaf surface, then pupate underground. Newly-emerged adults feed for a short period on small grains, grasses, or corn leaves, then become inactive for the rest of the summer. They move to an overwintering spot in fall. 1 generation per year	• Larvae scrape or skeletonize long strips of leaf. Older larvae, which occur in May, do the most feeding • Fields with heavy feeding on the flag leaf appear white or frosted • Heavy feeding can reduce plant growth and yield	• CLB feeds on all small grains, but spring-planted cereals are preferred over fall-planted • Late-planted fields in the fall, or thin stands, may attract more beetles in spring • Hot spots can be impressive & tend to be on field edges near tree lines where adults overwinter • Tillage and insecticide sprays will local parasitoid populations	Occasional & Localized Status upgraded from 'uncommon' in 2022 as we received more reports of issues
fall armyworm (FAW)	FAW is a tropical species. Adult moths migrate north, arriving mid to late summer. Eggs laid on leaves. Larvae feed on plants during the day. Pupation in soil. 1-3 generations, if the fall is warm. Larvae cannot overwinter in our area.	• Present later in the season, and thus a risk to winter wheat and fall-planted cover crops • Feeding starts on leaf margins. All leaves and small stems can be consumed under heavy infestations	• Strong winds from the SW carry moths northward • Warm conditions in late summer into fall can lead to several FAW generations	Uncommon and Sporadic A late-season outbreak in 2021 was the worst in ~30 years
grasshoppers	Eggs overwinter in soil. Nymphs emerge in June. Feeding increases	• Adults and nymphs chew on leaves, stems, or the head;	• Undisturbed forage, pasture, and	Uncommon

Pest (abbreviation)	Life cycle and Number of generations	Description of Damage	Conditions which favor infestation or damage	Pest Status in MI & OH
multiple species	with size, with large nymphs and adults consuming the most. Females lay groups of eggs in the undisturbed soil in late summer. 1 generation per year	feeding has a ragged appearance • Parts of leaves or the head may be clipped off	field margins are preferred egg-laying sites, so damage may be greater on edges near these habitats • A dry summer can lead to higher populations the following year	
grass sawfly	Sawflies are in the Order Hymenoptera, related to bees and wasps. Adults emerge in spring and lay eggs in April - early May. Larvae resemble Lepidoptera caterpillars but have 8 pairs of fleshy prolegs down the length of the body (vs. 5 pairs for armyworm). Larvae are bright to light green. Older larvae have a distinct dark stripe like a raccoon mask between the eyes. In June, larvae drop to the ground and remain underground to pupate and overwinter. 1 generation per year	• Larvae feed on leaves, but more importantly they tend to clip heads; a single caterpillar may clip 10-12 heads before dropping to the ground • After clipping a head, larvae often continue to chop off pieces of the stem, apparently to feed on the fresh ends. This results in stem pieces littering the ground	• On the East Coast, outbreaks tend to happen after an abnormally warm spring, which leads to more egg laying	Uncommon
Hessian fly	For winter wheat, adult flies emerge in fall and lay eggs on young plants. The mobile first stage maggots settle under leaf sheaths or in the crown to feed. Larvae are full grown before winter, overwintering in a protective shell (puparium) resembling a flax seed. Pupation occurs in spring, and adults emerge to infest wheat during stem elongation. Maggots of this generation feed and pupate under leaf sheathes. Pupae remain in wheat stubble until adult emergence in fall. 1 generation per year	• Maggots rasp the stem and rupture cells, affecting plant growth around the feeding site. Leaf blades on damaged tillers are wide, erect, and darker green or bluish in color compared to healthy plants • Tillers infested <u>in fall</u> can be stunted or dead by spring, thinning the overall stand. Heads, if present, will be small • Stems infested <u>in spring</u> can be weak and lodge over. Heads may be smaller or poorly filled	• Wheat fields planted near or into stubble of a previous wheat crop, a field with a wheat cover crop or volunteer wheat, or a wildlife plot. All of these are sources of infestation • Continuous no-till Note: Hessian fly is not an issue in oats or rye	Rare in Michigan Uncommon in Ohio
true armyworm (TAW)	Adult moths migrate north in early spring and lay eggs on small grains like wheat. Larvae develop in wheat and may 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 is most damaging	• Larvae feed from the ground up, often eating the flag leaf last. Large numbers can totally defoliate a field, then move into a neighboring crop • Larvae also clip heads off, especially if most foliage is gone. This results in heads on the soil surface	• Specific weather patterns carry moths northward in the spring	Sporadic Outbreaks occur in years when a heavy spring flight comes from the south
wheat curl mite	The tiny, white immatures and adults overwinter on wheat and alternate hosts, surviving brief exposures down	• Mites pierce and suck leaves, especially of new growth. Feeding causes the leaf edge	• Volunteer wheat provides a green bridge for mites to	Unknown

Pest (abbreviation)	Life cycle and Number of generations	Description of Damage	Conditions which favor infestation or damage	Pest Status in MI & OH
Note: curl mites are essentially microscopic, thus difficult to see with a hand lens in the field	to 0°F. In spring, eggs are laid on the host. A generation is completed in as little as 8-10 days under favorable (77°F) conditions. Mites cannot survive long off the plant, so when the wheat crop begins to dry, they move to the head and flag leaf to get picked up and moved for miles on wind currents. Field edges may be colonized first. Alternate hosts include corn, foxtail, and barnyard grass (plus volunteer wheat), until winter wheat is planted in the fall. In corn, mite feeding causes distinctive 'kernel red streak'. Multiple, overlapping generations	to curl inward. Mites live in the curl. Emerging leaves may get 'stuck' in the previous leaf's roll. As leaves mature, mites move to younger leaves • The most important impact is as a vector of a complex of viral diseases - wheat streak mosaic (WSMV), Triticum mosaic, and High Plains wheat mosaic	survive between July and fall planting • Planting before the fly-free date enables mites to colonize the new crop from alternate hosts • Hot, dry weather • Hail prior to harvest increases volunteer wheat	However, wheat streak mosaic was frequently found in recent surveys of Michigan wheat fields
white grubs *especially European chafer*	Adults (scarab beetles) emerge May-July, depending on species. Eggs are laid in the soil in the summer. The C-shaped larvae, or grubs, feed on organic matter and roots, then move down in the soil profile in late fall to overwinter (note that Euro chafer grubs feed late into the fall). In spring, annual grub species like chafer feed for a period, then pupate. June beetle grubs have a longer life cycle and may continue feeding for several seasons.	• Larvae (grubs) prune roots, causing wilting, deficiencies, or plant death. Euro chafer attacks winter wheat late into the fall and again in spring. June beetles may be present throughout the year • Heavy populations can thin or destroy areas of small grains; entire fields of winter wheat have been destroyed in the fall by European chafer • The adult beetles of most species do not feed	• June beetle and Euro chafer grubs are more common in fields with sandy soil types	Occasional When present, often localized to sandy parts of fields

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

Pest (abbreviation)	Notes on non-chemical and chemical management	Scouting recommendation	Threshold
aphids	• Biological: Aphids are attacked by numerous predators (ladybugs, lacewings, syrphids) & parasitoids which usually keep populations in check. These beneficials then move into neighboring crops later in the season. Under humid conditions, entomopathogenic fungi wipe out aphids • Agronomic: Planting after the Hessian fly 'fly safe' date in the fall reduces aphid infestation and BYDV transmission in winter wheat • Environmental: Adequate moisture (rainfall or irrigation) reduces aphid feeding stress and increases humidity for infection by fungal pathogens	Direct sampling: Count aphids on 100 tillers and calculate the average number per tiller Presence/absence method: Determine the number of tillers with aphids ('presence')	Direct sampling: 12-15 aphids per tiller in seedling to boot stage Presence/absence method: See Table 4A for instructions and the decision criteria
cereal leaf beetle	• Biological: After CLB was found in the US in the 1960s, it was the target of a highly successful biological control program. The parasitoids released by the USDA reduced CLB across the Midwest and they continue to provide free control, unless they are disrupted by unnecessary spraying • Insecticides: Do not add an insecticide to a fungicide spray simply as insurance, since this disrupts biocontrol. This practice may be why CLB is reemerging as a pest. Since infestations often start on field edges, limit treatment to that area to preserve local parasitoid numbers	Scout 20 plants in at least 5 sites in the field. Count the number of adult beetles, yellow eggs, and larvae	• Before boot: 3 or more eggs and/or larvae per stem • At heading: 1 or more larvae per stem
fall armyworm (FAW)	• Biological: Predators and parasitoids kill larvae • Agronomic: Planting after the Hessian fly 'fly safe' date in the fall should avoid FAW infestation • Insecticides: Applications are most effective on small larvae (less than ¾ inch)	No specific recommendation Note: To detect FAW flight into the region, use bucket pheromone traps	• Rough Guideline: 2 or more larvae per foot of row
grasshoppers	• Biological: Blister beetle larvae prey on eggs and many insects, rodents, and birds eat nymphs and adults. Fungal pathogens kill eggs and nymphs under moist, cool conditions • Agronomic: Tillage reduces survival of eggs and newly hatched nymphs • Insecticide: May be able to limit sprays to the field edge if hoppers invade from a neighboring field or grassy border	No specific recommendation Estimate number of hoppers per yd^2	Rough Guideline: • On the edge: > 15 nymphs or > 8 adults per yd^2 • Within a field: > 3 hoppers per yd^2
grass sawfly	• Insecticides: Although they resemble caterpillars, sawflies larvae are not Lepidoptera (butterflies and moths). Instead, they are in the Order Hymenoptera, closely related to bees, wasps, and ants. Thus, insecticides effective for caterpillar control may not work as well on sawflies	No specific recommendation	Untested guideline: Use a threshold of >2 larvae/ ft^2 at heading for the combo of armyworm and sawfly larvae Note: If larvae are >1 inch long & have a dark bar on their head, it is probably too late to treat
Hessian fly	• Variety: Resistant varieties are readily available which disrupt maggot feeding • Agronomic: Plant after the 'fly-safe' date for your area. Most egg-laying flies will have died out by this time. See Table 4B for dates by Michigan and Ohio county • Agronomic: Do not plant winter wheat near (within 400 yds) fields with wheat stubble. Tillage of wheat residue kills or buries puparia. Controlling volunteer wheat in harvested fields reduces egg laying sites • Agronomic: If using a grass cover crop in your system, choose rye or oats, which are not a host for Hessian fly	In fall: Check stems for symptoms ~ 3 weeks after emergence In spring: Check for broken stems	No thresholds are established Manage Hessian fly using a combination of planting date and resistant varieties

Pest (abbreviation)	Notes on non-chemical and chemical management	Scouting recommendation	Threshold
true armyworm (TAW)	• Biological: Predators, a tachinid parasitoid, and fungal pathogens kill armyworm larvae • Insecticides: Protect the flag leaf from feeding, but if it is gone, treatments may be justified if the stem is still green and contributing to filling the head. Spraying with a ground rig is often more effective than aerial application, but better coverage is balanced by yield loss from wheel tracks • Insecticides: If caterpillars are present in a limited part of a field, or if they are marching from one field to another, a limited spot or border treatment can be made • Soybeans are a non-host and do not need to be sprayed	Scout at least 5 sites in the field for leaf feeding and small larvae. Larvae hide during the day, so shake plants and check the ground to record their number and size Note: Pheromone traps aid in timing of scouting	Before heading: 4 or more larvae / ft^2 At heading 2 or more larvae/ ft^2 • If heads are being clipped, lean towards spraying • If larvae are > 1 inch they are nearing pupation and spraying is less effective
wheat curl mite	• Agronomic: Control volunteer wheat 2-3 weeks prior to planting and plant after the fly-safe date to reduce the green bridge for mites and wheat streak mosaic virus (WCMV) • Varieties: Some varieties are resistant to WSMV infection • Insecticides: Not effective in controlling wheat curl mite	No specific recommendation	No threshold
white grubs	• Biological: Natural enemies and pathogens kill grubs Note: it is important to identify grubs to species to distinguish annual species like European chafer from multi-year species of June beetle	No specific recommendation In poor stands, use a shovel to check for grubs and root pruning. Grubs tend to be patchy, especially in sandy fields	No threshold A density of 4 chafer grubs per ft^2 can reduce stand and biomass. In such fields, consider tillage before planting in fall or shift wheat elsewhere

Small Grains Table 4A: Presence/ absence decision table for aphids in wheat

Presence/absence sampling involves classifying tillers simply as infested (aphids present) or not. The aphid species and the number per tiller do not matter. When infestations are either low or high, this method quickly determines if a spray is warranted.

Instructions

- Pick 25 tillers and count the number infested with aphids.
- Use the first line of the table to determine the next step. If the infestation is low (18/25 tillers infested), stop sampling and check the field in a week. If the infestation is high (25/25 tillers infested), stop sampling and spray. Otherwise, keep going and sample 5 more tillers.
- Keep sampling groups of 5 tillers and using the new total until a decision is reached.

Total number of tillers examined	**Cumulative number of infested tillers**		
	Decision made *Stop sampling & do not spray*	***No decision yet*** *Keep sampling. Pick 5 more tillers*	***Decision made*** *Stop sampling & spray*
25	< 18	19 - 24	25
30	< 22	23 - 29	30
35	< 27	28 - 34	35
40	< 31	32 - 39	40
45	< 35	36 - 43	44 - 45
50	< 40	41 - 48	49 - 50
55	< 44	45 - 53	54 - 55
60	< 48	49 - 58	59 - 60
65	< 53	54 - 62	63 - 65
70	< 57	58 - 67	68 - 70
75	< 61	62 - 72	73 - 75
80	< 66	67 - 77	78 - 80
85	< 70	71 - 81	82 - 85
90	< 75	76 - 86	87 - 90
95	< 79	80 - 91	92 - 95
100	< 84	84 - 100 tillers = spray	

Small Grains Table 4B: Hessian fly 'fly-safe' dates for Michigan and Ohio

Based on your location (county), winter wheat should be planted after this date to avoid egg-laying by Hessian fly and to reduce infestation by grain aphids which transmit barley yellow dwarf virus

MICHIGAN			
County	**Date**	**County**	**Date**
Alcona	Sept 6	Monroe	Sept 21
Allegan	Sept 20	Montcalm	Sept 15
Alpena	Sept 9	Montmorency	Sept 7
Antrim	Sept 4	Muskegon	Sept 18
Arenac	Sept 13	Newaygo	Sept 15
Barry	Sept 18	Oakland	Sept 16
Bay	Sept 14	Oceana	Sept 16
Benzie	Sept 16	Ogemaw	Sept 10
Berrien	Sept 23	Osceola	Sept 10
Branch	Sept 19	Oscoda	Sept 7
Calhoun	Sept 19	Otsego	Sept 6
Cass	Sept 22	Ottawa	Sept 19
Charlevoix	Sept 3	Presque Isle	Sept 8
Cheboygan	Sept 4	Roscommon	Sept 7
Claire	Sept 12	Saginaw	Sept 16
Clinton	Sept 17	Sanilac	Sept 15
Crawford	Sept 6	St. Clair	Sept 16
Eaton	Sept 16	St. Joseph	Sept 23
Emmet	Sept 4	Shiawassee	Sept 16
Genesee	Sept 17	Tuscola	Sept 15
Gladwin	Sept 12	Van Buren	Sept 22
Grand Traverse	Sept 8	Washtenaw	Sept 18
Gratiot	Sept 15	Wayne	Sept 18
Hillsdale	Sept 19	Wexford	Sept 9
Huron	Sept 13		
Ingham	Sept 17		
Ionia	Sept 16		
Iosco	Sept 7		
Isabella	Sept 11		
Jackson	Sept 16		
Kalamazoo	Sept 20		
Kalkaska	Sept 5		
Kent	Sept 18		
Lake	Sept 13		
Lapeer	Sept 15		
Leelanau	Sept 8		
Lenawee	Sept 25		
Livingston	Sept 16		
Macomb	Sept 18		
Manistee	Sept 13		
Mason	Sept 13		
Mecosta	Sept 12		
Midland	Sept 15		
Missaukee	Sept 9		

OHIO			
County	**Date**	**County**	**Date**
Adams	Oct 4	Licking	Sept 29
Allen	Sept 26	Logan	Sept 28
Ashland	Sept 26	Lorain	Sept 23
Ashtabula	Sept 22	Lucas	Sept 22
Athens	Oct 2	Madison	Sept 30
Auglaize	Sept 27	Mahoning	Sept 25
Belmont	Sept 29	Marion	Sept 27
Brown	Oct 3	Medina	Sept 24
Butler	Oct 1	Meigs	Oct 3
Carroll	Sept 27	Mercer	Sept 27
Champaign	Sept 29	Miami	Sept 29
Clark	Sept 29	Monroe	Sept 30
Clermont	Oct 3	Montgomery	Sept 30
Clinton	Oct 2	Morgan	Oct 1
Columbiana	Sept 26	Morrow	Sept 27
Coshocton	Sept 28	Muskingum	Sept 29
Crawford	Sept 26	Noble	Sept 30
Cuyahoga	Sept 23	Ottawa	Sept 22
Darke	Sept 29	Paulding	Sept 24
Defiance	Sept 23	Perry	Sept 30
Delaware	Sept 28	Pickaway	Oct 1
Erie	Sept 23	Pike	Oct 3
Fairfield	Sept 30	Portage	Sept 24
Fayette	Oct 1	Preble	Sept 30
Franklin	Sept 30	Putnam	Sept 25
Fulton	Sept 22	Richland	Sept 26
Gallia	Oct 4	Ross	Oct 2
Geauga	Sept 23	Sandusky	Sept 23
Greene	Sept 30	Scioto	Oct 4
Guernsey	Sept 29	Seneca	Sept 24
Hamilton	Oct 3	Shelby	Sept 28
Hancock	Sept 25	Stark	Sept 26
Hardin	Sept 26	Summit	Sept 24
Harrison	Sept 28	Trumbull	Sept 23
Henry	Sept 23	Tuscarawas	Sept 28
Highland	Oct 3	Union	Sept 28
Hocking	Oct 1	Van Wert	Sept 26
Holmes	Sept 27	Vinton	Oct 3
Huron	Sept 24	Warren	Oct 2
Jackson	Oct 3	Washington	Oct 2
Jefferson	Sept 28	Wayne	Sept 26
Knox	Sept 28	Williams	Sept 22
Lake	Sept 22	Wood	Sept 23
Lawrence	Oct 5	Wyandot	Sept 26

Table 5: Foliar Insecticides to manage insect pests of wheat (and where indicated, other small grains) in Michigan and Ohio

- Insecticides are grouped by active ingredient(s), which are listed alphabetically, allowing for easy comparison of products with the same chemistry
- Application rates are listed for pests which appear on the label. If a column is blank, the pest is not on the label. The letters in the pest columns refer to the label use rate from column two

Active ingredient Trade Names	**Labelled rate per acre** (unless stated)	**aphids**	**cereal leaf beetle**	**fall armyworm**	**grasshoppers**	**grass sawfly**	**Hessian fly**	**true armyworm**	**Pre harvest interval (PHI)** in days	**Precautions and Remarks**
Bt (*Bacillus thuringiensis*) Xentari, Dipel DF Dipel ES Javelin WG	(a) 0.5 - 2.0 lbs (a) 2.0 - 4.0 pts (a) 1.0 - 1.5 lbs			a				a	0	• Labeled for wheat & barley, millet, oats, rye, triticale • 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, less than ¼ inch
chlorantraniliprole Coragen Prevathon Shenzi 400SC 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) 1.7 – 3.8 oz (b) 1.0 – 2.5 oz (a) 1.2 - 2.5 oz (b) 0.7 - 1.7 oz			a	b			a	1 grain 1 straw	• Labeled for wheat & barley, millet, oats, rye, sorghum, triticale • Novel mode of action. Insects are paralyzed & stop feeding. Must be applied before populations reach damaging levels
chlorantraniliprole + cyhalothrin (lambda) Besiege	(a) 6 oz - 10 oz (b) 8 oz - 10 oz	a	a	a	a	b	a	a	30 grain 30 straw 7 hay 7 grazing	• Labeled for wheat & barley, oats, rye, triticale • Check label for rates by aphid species
cyfluthrin Baythroid XL Tombstone Tombstone Helios	(a) 1.0 - 1.8 oz (b) 1.8 - 2.4 oz	b	a	b	b	b		b	30 grain 30 straw 3 grazing	• Baythroid - labeled for wheat & barley, oats, rye, triticale; Tombstone labeled only on wheat • Fall armyworm = control of 1st & 2nd instars only, less than ¼ inch • Helios formulation has UV protection for extended residual
cyhalothrin (gamma) Declare Proaxis	(a) 1.02 - 1.54 oz (b) 1.28 - 1.54 oz (a) 2.56 - 3.84 oz (b) 3.20 - 3.84 oz	a	a	a	a	b	a	a	30 grain 30 straw 7 grazing	• Declare is labeled for wheat & barley, oats, rye, triticale while Proaxis is labeled only for wheat and triticale

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cyhalothrin (lambda) Grizzly Too Kendo 22.8CS Lamcap II Province II Ravage II Warrior II w/Zeon Tech. Kendo Silencer Lambda Cyhalothrin 1EC Lambda-Cy Lambda-Cy Ag LambdaStar Lambda-T Paradigm VC Ravage Willowood Lambda-Cy1EC	(a) 1.28 - 1.92 (b) 1.60 - 1.92 (a) 2.56 - 3.84 oz (b) 3.20 - 3.84 oz	a	a	a	a	b	a	a	30 grain 30 straw 7 grazing 7 feed	• Labeled for wheat & barley, oats, rye, and triticale • Aphid control is variable with species • Fall armyworm: some labels indicate control of 1st & 2nd instars only
cypermethrin (alpha) Fastac EC or CS	(a) 1.8 - 3.8 oz (b) 3.2 - 3.8 oz	b	a	b	b	b		a	14	• Labeled for wheat & triticale • Aphid control may be 'variable' depending on which species are present
cypermethrin (zeta) Mustang Mustang Maxx	(a) 1.9 - 4.3 oz (b) 3.4 - 4.3 oz (a) 1.76 - 4.0 oz (b) 3.2 - 4.0 oz	b	a	b	b	b		a	14	• Labeled for wheat & barley, oats, rye, triticale • Aphid control may be 'variable' depending on which species are present
dimethoate Dimate 4E Dimethoate 400 & 4EC	(a) 0.5 - 0.75 pints (b) 0.75 pints	a			b				35 grain	• Labeled for wheat only
flupyradifurone Sivanto HL Sivanto 200 SL Sivanto Prime	(a) 3.5 - 7.0 oz (a) 7.0 - 10.5 oz (a) 7.0 - 14.0 oz	a							21 grain 21 straw	• Labeled for wheat & barley, millet, oats, rye, triticale • Systemic insecticide, particularly effective on sucking pests
GS-omega/kappa-Hxtx-Hv1a Spear-Lep	(a) 1 – 2 pts								0	• Novel mode of action. MUST be applied in conjunction with a low dose of Bt insecticide (see label for details). The Bt damages the caterpillar gut, allowing Spear-Lep to enter the body • Fun fact, this product is derived from the venom of an Australian spider

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pyrethrins Evergreen EC 60-6 Pyganic EC 1.4 II Pyganic 5.0	(a) 2.0 - 12.6 oz (a) 16.0 – 64.0 oz (a) 4.5 - 15.6 oz	a	a	a	a			a	0 when sprays dry	• Labeled for all cereal grains • Plant-derived insecticides that knock down insects quickly but have very short residual control. Coverage is critical • Pyganic is OMRI listed for use on organic crops but Evergreen is not
spinosad Blackhawk Tracer	(a) 1.1 - 1.3 oz (b) 1.7 - 3.3 oz (a) 1.5 - 3.0 oz		a	b				a	21 grain 21 straw 3 hay	• Labeled for wheat & barley, millet, oats, rye, triticale • For armyworm, time applications to coincide w/ egg hatch & small larvae • Application may suppress grasshoppers
sulfoxaflor Transform WG	(a) 0.75 - 1.5 oz	a							14 grain 14 straw 7 hay	• Labeled for wheat & barley, oats, rye, triticale