

WHEAT (and other small grains)

Calendar of insect pests in 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	

Damage checklist to aid in scouting of wheat in Michigan and Ohio

<u>Plant part or timing</u> Type of damage or injury	aphids	cereal leaf beetle	fall armyworm	grasshoppers	grass sawfly	Hessian fly	true armyworm	wheat curl mite	white grubs
<u>Stand (emergence)</u>									
wilted or stunted plants									x
gaps in row									x
fewer, or dead, tillers						x			x
widespread stand loss or thinning			x						x
<u>Roots</u>									
root hairs missing									x
pruning of whole roots									x
<u>Leaf tissue</u>									
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								
<u>Stem</u>									
short internodes and stems						x			
stunting of plants						x			
small lengths of cut stems on ground					x				
stem breakage, lodging						x			
<u>Head</u>									
awns clipped off							x		
heads clipped off					x		x		
<u>Other</u>									
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				

Biological and impact of insect pests in wheat in Michigan and Ohio

Terms used to describe the pest status of each insect

- **Rarely a pest:** Unusual. May not even be present in the state.
- **Uncommon pest:** Maybe present but below damaging levels. An outbreak once a generation
- **Occasional pest:** Present, sometimes in high numbers. An outbreak once a decade
- **Important pest:** Present in most fields, potentially increasing to damaging levels every season. A common target of scouting, management programs, or insecticide use.
- **Sporadic pest:** Damaging levels occur after favorable weather patterns (such as drought) or mass movement from south to north during the season
- **Localized pest:** 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	Impact on the Crop	Conditions which favor infestation or damage	Pest Status in MI & OH
aphids <i>multiple species: English grain aphid, bird cherry-oat aphid, corn leaf aphid, and greenbug</i>	<p>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.</p> <p>Multiple overlapping generations</p>	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • A warm fall can extend aphid activity and result in more BYDV transmission to winter wheat 	Occasional
cereal leaf beetle <i>Historic note: CLB was first found in the USA in 1962 in Berrien Co. Michigan</i>	<p>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.</p> <p>1 generation per year</p>	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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)	<p>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.</p> <p>1-3 generations, if the fall is warm. Larvae cannot overwinter in our area.</p>	<ul style="list-style-type: none"> • 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 	<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 	Uncommon and Sporadic A late-season outbreak in 2021 was the worst in ~30 years

Pest (abbreviation)	Life cycle and Number of generations	Impact on the Crop	Conditions which favor infestation or damage	Pest Status in MI & OH
grasshoppers <i>multiple species</i>	Eggs overwinter in soil. Nymphs emerge in June. Feeding increases 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	<ul style="list-style-type: none"> • Adults and nymphs chew on leaves, stems, or the head; feeding has a ragged appearance • Parts of leaves or the head may be clipped off 	<ul style="list-style-type: none"> • Undisturbed forage, pasture, and 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 	Uncommon
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	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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 sheaths. Pupae remain in wheat stubble until adult emergence in fall. 1 generation per year	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Specific weather patterns carry moths northward in the spring 	Sporadic Outbreaks occur in years when a heavy spring flight comes from the south

Pest (abbreviation)	Life cycle and Number of generations	Impact on the Crop	Conditions which favor infestation or damage	Pest Status in MI & OH
<p>wheat curl mite</p> <p><i>Note: curl mites are essentially microscopic, thus difficult to see with a hand lens in the field</i></p>	<p>The tiny, white immatures and adults overwinter on wheat and alternate hosts, surviving brief exposures down 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.</p> <p>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'.</p> <p>Multiple, overlapping generations</p>	<ul style="list-style-type: none"> • Mites pierce and suck leaves, especially of new growth. Feeding causes the leaf edge 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 	<ul style="list-style-type: none"> • Volunteer wheat provides a green bridge for mites to 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 	<p>Unknown</p> <p>However, wheat streak mosaic was frequently found in recent surveys of Michigan wheat fields</p>
<p>white grubs</p> <p><i>especially European chafer</i></p>	<p>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).</p> <p>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.</p>	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • June beetle and Euro chafer grubs are more common in fields with sandy soil types 	<p>Occasional</p> <p>When present, often localized to sandy parts of fields</p>

Management of insect pests in wheat in Michigan and Ohio

Pest (abbreviation)	Management options and notes	Scouting recommendation	Threshold
aphids	<ul style="list-style-type: none"> 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 	<p>Direct sampling: Count aphids on 100 tillers and calculate the average number per tiller</p> <p>Presence/absence method: Determine the number of tillers with aphids ('presence')</p>	<p>Direct sampling: 12-15 aphids <u>per tiller</u> in seedling to boot stage</p> <p>Presence/absence method: See Table 4A for instructions and the decision criteria</p>
cereal leaf beetle	<ul style="list-style-type: none"> 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 	<p>Scout 20 plants in at least 5 sites in the field. Count the number of adult beetles, yellow eggs, and larvae</p>	<ul style="list-style-type: none"> Before boot: 3 or more eggs and/or larvae <u>per stem</u> At heading: 1 or more larvae <u>per stem</u>
fall armyworm (FAW)	<ul style="list-style-type: none"> 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 ¼ inch) 	<p>No specific recommendation</p> <p>Note: To detect FAW flight into the region, use bucket pheromone traps</p>	<ul style="list-style-type: none"> Rough Guideline: 2 or more larvae per foot of row
grasshoppers	<ul style="list-style-type: none"> 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 	<p>No specific recommendation</p> <p>Estimate number of hoppers per yd²</p>	<p>Rough Guideline:</p> <ul style="list-style-type: none"> On the edge: > 15 nymphs or > 8 adults per yd² Within a field: > 3 hoppers per yd²
grass sawfly	<ul style="list-style-type: none"> 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 	<p>No specific recommendation</p>	<p>Untested guideline: Use a threshold of >2 larvae/ ft² at heading for the combo of armyworm and sawfly larvae</p> <p>Note: If larvae are >1 inch long & have a dark bar on their head, it is probably too late to treat</p>
Hessian fly	<ul style="list-style-type: none"> 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 	<p>In fall: Check stems for symptoms ~ 3 weeks after emergence</p> <p>In spring: Check for broken stems</p>	<p>No thresholds are established</p> <p>Manage Hessian fly using a combination of planting date and resistant varieties</p>

Pest (abbreviation)	Management options and notes	Scouting recommendation	Threshold
true armyworm (TAW)	<ul style="list-style-type: none"> • 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 	<p>Scout at least 5 sites in the field for leaf feeding and small larvae. Larvae hide during the day, so shake plants <u>and</u> check the ground to record their number and size</p> <p>Note: Pheromone traps aid in timing of scouting</p>	<p>Before heading: 4 or more larvae / ft²</p> <p>At heading 2 or more larvae/ ft²</p> <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Biological: Natural enemies and pathogens kill grubs <p>Note: it is important to identify grubs to species to distinguish annual species like European chafer from multi-year species of June beetle</p>	<p>No specific recommendation</p> <p>In poor stands, use a shovel to check for grubs and root pruning. Grubs tend to be patchy, especially in sandy fields</p>	<p>No threshold</p> <p>A density of 4 chafer grubs per ft² can reduce stand and biomass. In such fields, consider tillage before planting in fall or shift wheat elsewhere</p>

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 very low or high, this method quickly determines if a spray is needed.

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 or fewer tillers infested), stop sampling and do not spray. Check the field again in a week.
- If the infestation is high (all 25 tillers infested), stop sampling and spray.
- If the infestation is moderate (19 to 24 tillers infested), a decision can't be reached using the small sample of 25 tillers.

Keep sampling additional groups of 5 tillers, using the line with the new total as a guide, until a decision is reached.

Cumulative number of tillers examined	<u>Cumulative number of infested tillers</u>		
	<i>Decision made Stop sampling & do not spray</i>	<i>No decision Pick five more tillers</i>	<i>Decision made Stop sampling & spray</i>
25	1 - 18	19 - 24	25
30	19 - 22	23 - 29	30
35	23 - 27	28 - 34	35
40	28 - 31	32 - 39	40
45	32 - 35	36 - 43	44 - 45
50	36 - 40	41 - 48	49 - 50
55	41 - 44	45 - 53	54 - 55
60	45 - 48	49 - 58	59 - 60
65	49 - 53	54 - 62	63 - 65
70	54 - 57	58 - 67	68 - 70
75	58 - 61	62 - 72	73 - 75
80	62 - 66	67 - 77	78 - 80
85	67 - 70	71 - 81	82 - 85
90	71 - 75	76 - 86	87 - 90
95	76 - 79	80 - 91	92 - 95
100	79 - 84	84 - 100 tillers = spray	

Hessian 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				OHIO			
County	Date	County	Date	County	Date	County	Date
Alcona	Sept 6	Monroe	Sept 21	Adams	Oct 4	Licking	Sept 29
Allegan	Sept 20	Montcalm	Sept 15	Allen	Sept 26	Logan	Sept 28
Alpena	Sept 9	Montmorency	Sept 7	Ashland	Sept 26	Lorain	Sept 23
Antrim	Sept 4	Muskegon	Sept 18	Ashtabula	Sept 22	Lucas	Sept 22
Arenac	Sept 13	Newaygo	Sept 15	Athens	Oct 2	Madison	Sept 30
Barry	Sept 18	Oakland	Sept 16	Auglaize	Sept 27	Mahoning	Sept 25
Bay	Sept 14	Oceana	Sept 16	Belmont	Sept 29	Marion	Sept 27
Benzie	Sept 16	Ogemaw	Sept 10	Brown	Oct 3	Medina	Sept 24
Berrien	Sept 23	Osceola	Sept 10	Butler	Oct 1	Meigs	Oct 3
Branch	Sept 19	Oscoda	Sept 7	Carroll	Sept 27	Mercer	Sept 27
Calhoun	Sept 19	Otsego	Sept 6	Champaign	Sept 29	Miami	Sept 29
Cass	Sept 22	Ottawa	Sept 19	Clark	Sept 29	Monroe	Sept 30
Charlevoix	Sept 3	Presque Isle	Sept 8	Clermont	Oct 3	Montgomery	Sept 30
Cheboygan	Sept 4	Roscommon	Sept 7	Clinton	Oct 2	Morgan	Oct 1
Claire	Sept 12	Saginaw	Sept 16	Columbiana	Sept 26	Morrow	Sept 27
Clinton	Sept 17	Sanilac	Sept 15	Coshocton	Sept 28	Muskingum	Sept 29
Crawford	Sept 6	St. Clair	Sept 16	Crawford	Sept 26	Noble	Sept 30
Eaton	Sept 16	St. Joseph	Sept 23	Cuyahoga	Sept 23	Ottawa	Sept 22
Emmet	Sept 4	Shiawassee	Sept 16	Darke	Sept 29	Paulding	Sept 24
Genesee	Sept 17	Tuscola	Sept 15	Defiance	Sept 23	Perry	Sept 30
Gladwin	Sept 12	Van Buren	Sept 22	Delaware	Sept 28	Pickaway	Oct 1
Grand Traverse	Sept 8	Washtenaw	Sept 18	Erie	Sept 23	Pike	Oct 3
Gratiot	Sept 15	Wayne	Sept 18	Fairfield	Sept 30	Portage	Sept 24
Hillsdale	Sept 19	Wexford	Sept 9	Fayette	Oct 1	Preble	Sept 30
Huron	Sept 13			Franklin	Sept 30	Putnam	Sept 25
Ingham	Sept 17			Fulton	Sept 22	Richland	Sept 26
Ionia	Sept 16			Gallia	Oct 4	Ross	Oct 2
Iosco	Sept 7			Geauga	Sept 23	Sandusky	Sept 23
Isabella	Sept 11			Greene	Sept 30	Scioto	Oct 4
Jackson	Sept 16			Guernsey	Sept 29	Seneca	Sept 24
Kalamazoo	Sept 20			Hamilton	Oct 3	Shelby	Sept 28
Kalkaska	Sept 5			Hancock	Sept 25	Stark	Sept 26
Kent	Sept 18			Hardin	Sept 26	Summit	Sept 24
Lake	Sept 13			Harrison	Sept 28	Trumbull	Sept 23
Lapeer	Sept 15			Henry	Sept 23	Tuscarawas	Sept 28
Leelanau	Sept 8			Highland	Oct 3	Union	Sept 28
Lenawee	Sept 25			Hocking	Oct 1	Van Wert	Sept 26
Livingston	Sept 16			Holmes	Sept 27	Vinton	Oct 3
Macomb	Sept 18			Huron	Sept 24	Warren	Oct 2
Manistee	Sept 13			Jackson	Oct 3	Washington	Oct 2
Mason	Sept 13			Jefferson	Sept 28	Wayne	Sept 26
Mecosta	Sept 12			Knox	Sept 28	Williams	Sept 22
Midland	Sept 15			Lake	Sept 22	Wood	Sept 23
Missaukee	Sept 9			Lawrence	Oct 5	Wyandot	Sept 26

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 (<i>Bacillus thuringiensis</i>) 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	<ul style="list-style-type: none"> • Labeled for wheat & barley, millet, oats, rye, triticale • Bts are biological insecticides that must be eaten to kill, so coverage is important. Applications ideally are made when larvae are small. Check labels for rates on specific caterpillar species, larval sizes, and infestation levels
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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Declare is labeled for wheat & barley, oats, rye, triticale while Proaxis is labeled only for wheat and triticale

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
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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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

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
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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Labeled for wheat & barley, oats, rye, triticale