

## Insecticide Options in 2023

Lambda-cyhalothrin, belonging to the synthetic pyrethroids chemical group (Group 3), is a widely used insecticide with extensive product labels covering key pests of numerous pulse, cereal, and oilseed crops. Extensive outbreaks of flea beetles, grasshoppers, and pea aphids during the 2022 growing season serve as a recent reminder of how valuable this ingredient is to have in the crop production toolbox.

The re-evaluation decision on lambda-cyhalothrin and its associated end-use products ([Pest Management Regulatory Agency \(PMRA\), 2021](#)) resulted in the cancellation of all feed uses. After April 2023, if a crop is treated with lambda-cyhalothrin according to label provisions, that crop and its components (fractions, meal, screenings) cannot be fed to any livestock in Canada. This label change results in an unmanageable risk mitigation option as many crops are grown for both food and feed, with no segregation by food or feed in our bulk grain handling system.

Due to the cancellation of the feed use and the challenges that this presents to the entire value chain, the availability of products containing lambda-cyhalothrin and farmers ability to utilize these products for the 2023 growing season is uncertain. A worst-case scenario is that all products containing lambda-cyhalothrin will be effectively unusable during the 2023 growing season. Therefore, it is important to consider alternative active ingredients and product options for insect pest control. The following document provides information on thresholds and damage of key pests covered by labels of products containing lambda-cyhalothrin and summarizes alternative options for foliar, seed treatment, and grasshopper bait products.

## Key Pests & Thresholds

It is important that growers and agronomists diligently scout for insect pests that impact their crops as rapid outbreaks can occur that may severely impact crop yield or quality (Table 1). However, presence of a pest insect alone does not automatically warrant an insecticide application as it is important to consider crop stage, environmental conditions, threshold information, and presence of beneficial insects.

**Economic Injury Level** describes the lowest amount of crop injury or smallest number of insect pests that cause damage at a value equivalent to the economic costs of management.

**Economic Threshold** describes the level of damage or density of insects at which control measures are economically warranted. Under these conditions, the cost of control is less than the value of the crop damage due to pest pressure. Intervening at this timing is intended to prevent an increasing pest population from reaching the economic injury level.

**Nominal Threshold** describes a decision guideline only. This educated estimate is based on experience or from extrapolating economic threshold information from pests that impact similar crop hosts. Research has not been conducted to quantify the impact of the insects on the specific crop.

Table 1. Summary of key pests and crop hosts including damage and intervention guidelines.

Crop(s)	Intervention Guidelines
<b>Bertha Armyworm:</b>	<i>Causes defoliation evidenced by outer layers of stems and pods chewed resulting in whitish appearance and holes chewed in pods. Scout for larvae two weeks after peak adult emergence (usually late July through early August) by shaking plants in a ¼ square metre area and carefully check soil surface for dislodged larvae. Provincial Ag Ministries trap adults and post results, weekly on provincial websites and through the Prairie Pest Monitoring Network. It takes about 6 weeks to complete development. During heat of the day, larvae will often be found under leaves or on soil surface. Small larvae can be easily confused with diamondback moth larvae but don't wriggle or drop from silken threads. To help get an idea of potential risk levels, consider participating in the provincial monitoring programs.</i>
<b>Canola, Mustard</b>	Find the number of larvae per square metre and consult the economic threshold chart on Canola Encyclopedia.
<b>Cabbage Seedpod Weevil:</b>	<i>Although adults feed on flower buds, most of the economic crop damage occurs when larvae feed within pods and destroy developing seeds. When larvae exit pods, they leave small holes which leave the pods susceptible to premature shattering. Scout as crops begin to flower and, if warranted, apply insecticide to target adults when crops are 10–20% flower to avoid eggs being laid in newly formed pods.</i>
<b>Canola, Mustard</b>	An economic threshold of 25–40 weevils per 10 sweeps on average is recommended. An insecticide should be applied at 10–20% bloom. Yellow mustard is resistant and only brown and oriental mustard varieties require monitoring and potentially insecticide control of the weevil.
<b>Cutworm:</b>	<i>Scout for cutworms from emergence to early July. Look for notched, wilted, dead, or cut-off plants with plants missing from rows or bare patches appearing in field. Often, cutworms will be close to damaged plants and on the edges of bare patches and can be most abundant in patches or a specific area of a field. Hilltops, south facing slopes and drier parts of the field are most susceptible but they can be located anywhere in field. If damage is observed but no cutworms are seen, search through the top 2–6 cm of soil to confirm cutworms are the cause as larvae feed primarily at night and burrow underground during heat of day.</i>
<b>Chickpea, Dry bean, Soybean</b>	A nominal threshold of one or more larvae per metre of row, when larvae are small (less than 2 cm), or 20% of plants cut
<b>Lentil, Pea</b>	2–3 cutworms per square metre. Sometimes it is most economical to just treat infested patches, and not whole fields
<b>Barley, Oat, Wheat</b>	3–4 larvae per square metre (Pale western, Dingy) and 5–6 larvae per square metre (Red-backed) Sometimes it is most economical to just treat infested patches, and not whole fields
<b>Canola, Flax, Mustard</b>	Nominal threshold of 25–30% stand reduction has been suggested. An economic threshold of 4–6 larvae per square metre may warrant control for pale western, redbacked and darksided cutworms. Sometimes it is most economical to just treat infested patches, and not whole fields.

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Crop(s)	Intervention Guidelines
<b>Diamondback Moth:</b> Larval feeding damage to leaves is usually considered to have a minor effect on yield, but larval feeding on buds and flowers can be more damaging, especially when plants are under abiotic stress (such as drought) and cannot compensate by producing new buds and flowers. Scout for diamondback moth larvae from late May through to early September by shaking plants to dislodge larvae from canopy. It takes about 32 days to develop from egg to adult, and there may be several generations per year.	
<b>Canola, Mustard</b>	100 to 150 larvae per square metre in immature to flowering plants. 200–300 larvae per square metre in plants with flowers and pods. These threshold numbers are based on stands averaging 150–200 plants per square metre. In areas where stands are thinner, the economic threshold should be lowered accordingly. A nominal threshold of 25–33% percent defoliation with larvae still present can be applied at seedling stage.
<b>Flea Beetle:</b> Shot-holes in leaves to complete destruction of seedling plants from stem feeding in late May through June. Holes chewed in pods in August (occasional). No economic threshold established for fall populations.	
<b>Canola, Mustard</b>	When 25% of leaf surface defoliation and flea beetles are continuing to feed. Inspect stems and petioles when scouting. If damage is only along the field margins and beetles are still congregated there, then control measures should be applied to the damaged areas only.
<b>Grasshopper:</b> Crop damage through defoliation of leaves or clipping of pods and flowers. Most problematic in dry areas (receiving less than 750 mm per year via rain or snow). The most serious economic damage due to grasshoppers begins when they are in the third to fifth nymphal stages (wing buds begin to show). Lentil and flax crops are particularly sensitive to grasshopper damage and can sustain direct yield loss through the clipping of flowers, pods, or bolls from the plant and, therefore, monitoring is crucial from the early bud stage through pod or boll development.	
<b>Chickpea, Soybean</b>	Generally, not a preferred host for grasshopper unless other food sources are low. May notice grasshoppers feeding on weeds in field preferentially to crops
<b>Dry Bean</b>	Substantial yield loss does not occur until up to 35% defoliation occurs before bloom and 15% after bloom
<b>Faba bean</b>	Economic thresholds have not been established, but faba bean is a better host than some other legumes to two-striped grasshopper
<b>Lentil</b>	Two grasshoppers per square metre during the flowering and podding stages. Damage accumulates on flowers.
<b>Pea</b>	Typically, counts of less than ten grasshoppers per square metre will not cause economic losses. Peas are not a preferred host of some grasshopper species.
<b>Cereals</b>	Eight to 12 grasshoppers per square metre
<b>Canola, Mustard</b>	Seven to 12 grasshoppers per square metre. The higher end of that range may be more appropriate in a typical canola crop as, given a choice, most grasshopper species prefer cereals to canola. However, in very hot and dry conditions, economic loss can be experienced at even lower than seven grasshoppers per square metre
<b>Flax</b>	Two grasshoppers per square metre once bolls have formed
<b>Lygus Bug:</b> Adults and nymphs pierce plant tissue to suck plant sap and inject digestive enzymes. Lygus at the third instar or larger can damage buds, flowers, and seeds. Lygus bug adults can be confused with alfalfa plant bug adults. Feeding on seeds leads to discoloration (chalk spot) or darkening and shriveling which can be particularly concerning for downgrading in faba bean marketed for human consumption. Recent research has shown that low levels of lygus in canola may have a neutral or positive yield impact due to compensatory growth, in good growing conditions.	
<b>Faba bean</b>	Research on-going to develop economic threshold. Preliminary information recommends no action when there is two adults or later instar nymphs per sweep
<b>Lentil</b>	10 or more lygus per 25 sweeps. If 7–10 lygus per 25 sweeps are found, continue monitoring. If less than 7 lygus per 25 sweeps are found, no treatment is necessary. A single insecticide application at late flowering to early pod should be sufficient for control
<b>Canola</b>	Nominal threshold of 2–3 per sweep at late flower to early pod
<b>Pea Aphid:</b> Crop damage is caused by sucking plant sap. Yield loss, due to reduced seed formation and size, results from feeding on the flowers and early pods. As such, the key scouting and intervention timing is during flowering to early pod development. Regular scouting is key as aphid populations can both be regulated by beneficial insects but also increase rapidly to their ability to produce multiple generations per year.	
<b>Chickpea</b>	No thresholds established. Pea aphids typically not an insect of concern
<b>Faba</b>	Economic threshold of 34–50 aphids per main branch provides an approximate 7-day lead time before populations reach economic injury level (96–142 per main branch)
<b>Lentil</b>	Economic threshold of 29–43 aphids per sweep provides an approximate 7-day lead time before populations reach economic injury level (64–92 per sweep)
<b>Pea</b>	Economic threshold of 2–3 aphids per 8-inch plant tip, or 9–12 aphids per sweep when approximately 25% has begun to flower

### Alternative Foliar Options

Various foliar insecticide products exist that provide solutions for the pest and crop combinations covered on the lambda-cyhalothrin labels (Tables 2 and 3). Beware, product options will differ in their efficacy, toxicity for user, cost, and market availability. Where options are available, rotating modes-of-action is an important resistance management strategy. Take into consideration the number of applications that can be made in a growing season with each insecticide and start to plan accordingly. Furthermore, applying registered product options according to label guidelines, within the targeted preharvest interval (PHI), and according to application strategies that promote the most efficacious result are all important considerations for successful pest management.

**Preharvest Interval (PHI)** is the minimum number of days between the last application of a pesticide and when the crop can be harvested. Harvest is the cutting of the crop or removal of the produce from the plant. It includes direct-combining, cutting (swathing) or grazing; it does not include swath-combining or baling for hay. Following PHI guidelines on pesticide labels is important to ensure that the maximum residue limit (MRL) for a crop is not exceeded.

**Maximum Residue Limit (MRL)** is the maximum amount of pesticide residues that are tolerated on or in a food product; Actual amounts should be lower than these values when the pesticide is used according to label directions. This value is legally established in accordance with Health Canada’s scientific assessments that determine the consumption of the treated food products will not be a concern for human health.

**Table 2.** Foliar insecticide options for pest and crops. Preharvest interval (PHI) is denoted by number of days in brackets behind the crop. Certain products have a maximum stage of application rather than a PHI.

Active Ingredient	Product(s)	Pulses (PHI) <sup>1</sup>	Cereals (PHI)	Oilseeds (PHI)
<b>Bertha Armyworm</b>				
Chlorantraniliprole	Coragen®/Coragen® MaX			Canola (1), Flax (1), Mustard (1)
Cypermethrin	UP-Cyde® 2.5 EC, Ship 250 EC			Canola (30)
Deltamethrin	Decis®100 EC/ Decis®5EC			Canola (7), Flax (7), Mustard (7)
	Advantage Deltamethrin 5EC, Poleci® 2.5 EC			Canola (7), Mustard (7)
<b>Cabbage Seedpod Weevil</b>				
Deltamethrin	Decis®100 EC/ Decis®5EC, Advantage Deltamethrin 5EC, Poleci® 2.5 EC			Canola (7), Mustard (7)
<b>Cutworm</b>				
Chlorantraniliprole	Coragen®/Coragen® MaX	Chickpea (1), Dry bean (1), Faba bean (1), Lentil (1), Pea (1), Soybean (1)	Barley (1), Oat (1), Wheat (1)	Canola (1), Flax (1), Mustard (1)
Cypermethrin	UP-Cyde® 2.5 EC		Barley (40), Wheat (40), Oat (31)	
Deltamethrin	Decis®100 EC/ Decis®5EC	Chickpea (7), Dry bean (7), Faba bean (7), Lentil (7), Pea (7)	Barley (40), Wheat (40), Oat (31)	Flax (40), Canola (7)
	Advantage Deltamethrin 5EC, Poleci® 2.5 EC	Lentil (30)		
Permethrin	Pounce® 384 EC, Perm-Up®, IPCO Syncro, Ambush®	Lentil (5 leaf), Pea (5 leaf)	Barley (5 leaf), Oat (5 leaf), Wheat (5 leaf)	Canola (5 leaf), Flax (5 leaf)
		Lentil (7), Pea (7)	Barley (7), Oat (7),	
Tetraniliprole	Vayego® 200 SC	Soybean (14)		
<b>Diamondback Moth Larvae</b>				
Chlorantraniliprole	Coragen®/Coragen® MaX			Canola (1), Mustard (1)
Deltamethrin	Decis®100 EC/ Decis®5EC, Advantage Deltamethrin 5EC, Poleci® 2.5 EC			Canola (7)
Malathion	Malathion 85E, Malathion 500			Canola (7)
<b>Flea Beetle<sup>2</sup></b>				
Carbaryl	Sevin XLR			Canola (seedling)
Cypermethrin	UP-Cyde® 2.5 EC, Ship 250 EC			Canola (30), Mustard (30)
Deltamethrin	Decis®100 EC/ Decis®5EC, Advantage Deltamethrin 5EC, Poleci® 2.5 EC			Canola (7), Mustard (7)
Malathion	Malathion 85E			Canola (7), Mustard (7)
Malathion	Malathion 500			Canola (7)
Permethrin	Pounce® 384 EC, Perm-Up®, IPCO Syncro, Ambush®			Canola (5 leaf)
<b>Grasshopper</b>				
Chlorantraniliprole	Coragen®/Coragen® MaX	Chickpea (1), Dry bean (1), Faba bean (1), Lentil (1), Pea (1), Soybean (1)	Barley (1), Oat (1), Wheat (1)	Canola (1), Flax (1), Mustard (1)
Cypermethrin	UP-Cyde® 2.5 EC		Barley (45), Wheat (30)	Canola (30)
Deltamethrin	Decis®100 EC/ Decis®5EC	Chickpea (7), Dry bean (7), Faba bean (7), Pea (7)	Barley (40), Oat (31), Wheat (40)	Canola (7), Flax (7), Mustard (7)
	Advantage Deltamethrin 5EC, Poleci® 2.5 EC		Barley (40), Oat (31), Wheat (40)	Canola (7), Flax (40), Mustard (7)
Dimethoate	Cygon® 480-Ag			Canola (21)
	Lagon® 480		Barley (35), Oat (35), Wheat (35)	
Malathion	Malathion 85E	Lentil (14)	Barley (7), Oat (7), Wheat (7)	Canola (7), Flax (7), Mustard (7)
	Malathion 500	Lentil (30)	Barley (7), Oat (7), Wheat (7)	Canola (7), Flax (7)
<b>Lygus Bug</b>				
Carbaryl	Sevin® XLR	Dry bean (5)		
Deltamethrin	Decis®100 EC/ Decis®5EC	Dry bean (7), Faba bean (7), Lentil (7)		Canola (7), Flax (7), Mustard (7)
	Advantage Deltamethrin 5EC, Poleci® 2.5 EC			Canola (7), Mustard (7)
Dimethoate	Cygon® 480	Dry bean (7), Soybean (30),		Canola (21)
	Lagon® 480	Soybean (30)		
Flonicamid	Carbine™	Chickpea (7), Dry bean (7), Faba bean (7), Lentil (7), Pea (7)		

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Active Ingredient	Product(s)	Pulses (PHI) <sup>1</sup>	Cereals (PHI)	Oilseeds (PHI)
<b>Pea Aphid</b>				
Dimethoate	Cygon® 480	Pea (3)		
	Lagon® 480	Pea (21)		
Flonicamid	Carbine™	Chickpea (7), Dry bean (7), Faba bean (7), Lentil (7), Pea (7)		
Flupyradifurone	Sivanto® Prime	Chickpea (7), Faba bean (7), Lentil (7), Pea (7)		
Malathion	Malathion 85E	Pea (3)		
Spirotetramat	Movento®	Chickpea (7), Lentil (7), Pea (7)		

Information adapted from [Saskatchewan Guide to Crop Protection](#). Consult label or manufacturer for more detail. Always read and follow label directions. This information is only a guide, if label information differs, follow label instructions.

**NOTE:** As of December 2020, all productions and formulations of insecticides containing chlorpyrifos (Lorsban™ 4E, Pyrinex® 480EC, Nufos® 4E, Citadel 480 EC, Pyrifos® 15G, Warhawk® 480, and Sharpfos) have been cancelled by PMRA. Retailers had until December 2022 to sell remaining inventory to producers. In turn, producers have until December 2023 to apply any remaining products before the product is officially unregistered and unusable for application.

<sup>1</sup>PHI= Preharvest interval denoted by number of **days** in brackets behind crop. **Max stage of application** is indicated for some products.

<sup>2</sup>Not all product labels claim control of both crucifer and striped flea beetle. Refer to specific product label for more information.

Table 3. Description of mode of action based on chemical group and active ingredient.

Active Ingredient	Product(s)	How it Works & Application Considerations <sup>1,2</sup>
<b>Carbamates (1A)</b>		
Carbaryl	Sevin® XLR	Contact and ingestion activity. Applications in canola can be made up to four weeks following plant emergence
<b>Organophosphates (1B)</b>		
Dimethoate	Cygon® 480 AG, Lagon® 480	Provides contact and stomach activity in insect. Local systemic activity—penetrates the leaf and gets to the underside to kill aphids, with a few days of extended control. Active under a wide range of application temperatures, including warm periods.
Malathion	Malathion 85E, Malathion 500	Non-systemic, contact with brief to moderate persistence. Apply when daytime temperatures are above 20°C using sufficient water for good coverage. Use higher label rates for heavy infestations, dense canopy, or mature stages of insects. Do not use in bins where canola will be stored.
<b>Pyrethroids (3A)</b>		
Cypermethrin	UP-Cyde® 2.5 EC, Ship 250 EC	Works as a contact and stomach poison. Use sufficient water for good coverage. Control of immature (up to 4th instar) grasshoppers only and use higher label rates for mature insect stages (grasshoppers) or severe infestations. Activity of grasshoppers is reduced as soil temperature increases. Application for grasshopper control should be made at temperatures below 25°C. Spraying for grasshoppers should be delayed until evening if daytime temperatures are above 25°C. After application for cutworm leave soil surface undisturbed for five days.
Deltamethrin	Decis®100 EC/ Decis®5EC, Advantage Deltamethrin 5EC, Poleci® 2.5 EC	Non-systemic active that works by contact and ingestion. Use sufficient water for good coverage and higher rates for severe infestations, on dense foliage or when several insect growth stages are present. Spraying under a strong temperature inversion, when temperature exceeds 25° C, or within one hour of rain will result in a reduction in control. Best control achieved when deltamethrin is applied during cooler periods of the day.
Permethrin	Pounce®, Perm-Up®, IPCO Syncro, Ambush®	Works as a contact and stomach poison with no systemic or fumigant properties. Use sufficient water for good coverage and higher label rates for severe infestations, adult insects, and dense foliage. For cutworm control, application should be made under warm, moist conditions in the evening or at night. Use high rates if larvae are near maturity or soil conditions are dry. Do not disturb soil surface for five days after treatment.
<b>Butenolides (4D)</b>		
Flupyradifurone	Sivanto® Prime	Broad spectrum systemic activity that works by contact and ingestion. Do not apply within one hour of rain. Apply in a minimum water volume of 10 gallons US gallons (USG) per acre.
<b>Tetronic/Tetramic Acid Derivatives (23)</b>		
Spirotetramat	Movento®	Systemic movement through phloem and xylem to all plant tissues including new shoot, leaf, and root growth. Apply in minimum of 30 USG per acre. Mode of action is primarily by ingestion by immature insect life stages. Insect death occurs due to the inability to progress to the next development stage. Adults produce less offspring following exposure. For best results apply when insect populations begin to build and before a damaging population becomes established.
<b>Diamides (28)</b>		
Chlorantraniliprole	Coragen®/Coragen® MaX	Works through ingestion of treated plant material and causes muscle paralysis in the insect; feeding quickly comes to a stop in as little as seven minutes. The grasshopper will become lethargic and die, although complete death may take up to a few days after ingestion. Thorough coverage is essential for optimal control. Use the high rate under heavy pest pressure and/or when larger larvae are present.
<b>Fonicamids (29)</b>		
Fonicamid	Beleaf® 50SG, Carbine™	Mode of action is contact and ingestion. This provokes rapid and irreversible feeding cessation. The mouthpart is impaired, and pest is unable to penetrate plant tissues. Complete death may take up to a few days after coming into contact and/or ingestion of product. Apply in sufficient water for good coverage. Rates and spray volumes should be increased under extreme pest populations or dense foliage.

<sup>1</sup>Information adapted from [Saskatchewan Guide to Crop Protection](#). Consult label or manufacturer for more detail. Always read and follow label directions. This information is only a guide, if label information differs, follow label instructions.

<sup>2</sup>Certain products such as Sivanto® Prime, Movento®, Beleaf® 50SG, and Vayego® 200 SC are predominately used in horticulture markets and, therefore, cost and accessibility may be prohibitive to their use in Saskatchewan pulse, cereal, and oilseed crops.

### Seed Treatment Choices

Insecticidal seed treatments are not effective against later season pests, but they do offer protection against damage from early-season feeding of cutworm and flea beetles. Seed treatments are also recommended for protection against pea leaf weevil in pea and faba bean crops as the most critical damage comes from the larvae feeding on the nodules and research indicates that foliar insecticide, which targets adults, does not prevent yield loss. Insecticidal seed treatments protect crops from other insect pests below the surface as well. For more information on additional insect pests and insecticidal seed treatment options, consult the [Guide to Crop Protection](#).

Formulated as seed treatments the active ingredients that target cutworm, flea beetle, and pea leaf weevil, work via ingestion and fall into three chemical groups: Neonicotinoids (clothianidin, imidacloprid, and thiamethoxam), Butenolides (flupyradifurone) and Diamides (chlorantraniliprole, clothianidin, and cyantraniliprole) (Table 4).

**Table 4: Summary of seed treatment options that target cutworm, flea beetle, and pea leaf weevil pests.**

Pest	Active Ingredient	Product(s)	Pulses	Cereals	Oilseeds
Cutworm	Chlorantraniliprole	Lumivia™ CPL	Chickpea, Dry bean, Faba bean, Lentil, Pea	Barley, Oat, Wheat	
	Cyantraniliprole	Fortenza® Advanced, Lumiderm™			Canola, Mustard
Flea Beetle	Clothianidin	NipsIt INSIDE®			Canola
	Clothianidin	Prosper® EverGol®			Canola, Mustard
	Cyantraniliprole	Fortenza® Advanced, Lumiderm™			Canola, Mustard
	Flupyradifurone	BUTEQ™ Start			Canola
	Imidacloprid	Sombbrero® 600 FS			Canola, Mustard
	Thiamethoxam	Helix® Vibrance®			Canola
Pea Leaf Weevil	Chlorantraniliprole	Lumivia™ CPL	Chickpea, Dry bean, Faba bean, Lentil, Pea		
	Thiamethoxam	Cruiser® 5FS	Faba bean, Pea		
	Imidacloprid	Trilex® EverGol® SHIELD	Faba bean, Pea		

Consult label or manufacturer for more detail. Always read and follow label directions. This information is only a guide, if label information differs, follow label instructions. Check inoculant compatibility when applying seed treatment with a liquid or peat inoculant on pulse crops.

### Grasshopper Bait Products

Spreadable wheat bran bait products offer additional solutions for grasshopper control and use as part of an integrated pest management protocol. Registered use varies by product, but Eco Bran (dry bean, barley, oat, wheat, canola) or Nolo Bait™ (all crops) are both registered for application on field borders and headlands. These bran products need to be spread over the soil surface using a specialized mechanical applicator or valmar and often require repeat applications.

Eco Bran and Nolo Bait™ work via ingestion and require that the grasshoppers consume the product. Following consumption of the bait, grasshoppers typically die in 18 hours to 3 days (Eco Bran) and 3 to 6 weeks (Nolo Bait™). For both products, applications should be made when grasshoppers are small (in the 3rd instar stage) with higher rates needed for larger grasshoppers or denser populations.

Eco Bran contains carbaryl as the insecticide active ingredient and is formulated to not breakdown under UV light for up to 21 days when applied in fields. However, if applied Eco Bran has disintegrated due to rain and is no longer visible in treated areas it will need to be reapplied. Despite previous supply limitations, the manufacturer (Peacock Industries) has indicated availability of Eco Bran for the upcoming season.

Nolo Bait™ is an organic product comprised of wheat bran coated with spores of the protozoan *Nosema locustae*. Upon ingestion, infection via the protozoa results in sickness of the grasshopper. As the *Nosema locustae* population increases inside the grasshopper it becomes lethargic, reduces its feeding and has lowered reproductive capacity. Availability of Nolo Bait™ remains uncertain for the 2023 season due to internal supply issues cited by the manufacturer (M&R Durango Inc.).

### Integrated Pest Management

This publication covers insecticide options to manage insect pests. Insecticides are one part of an integrated pest management plan. Planning and including practices that reduce or discourage insect pests is cost-effective management. More information on integrated pest management is available in the references and additional resources at the end of this publication.

An important component of integrated pest management is pest monitoring. Pest monitoring programs are underway each year in Saskatchewan. They are used to create forecast maps, inform research decisions, and monitor for emerging pest issues, as well as guide management and field specific monitoring activities.

Pest monitoring surveys are now permission based. Consider [signing up online](#) with the Saskatchewan Ministry of Agriculture’s pest monitoring program.

### References & Additional Resources

- [Saskatchewan Guide to Crop Protection](#)
- [Field Heroes](#)
- [Grasshoppers in Pulse Crops](#)
- [Grasshopper ID Webinar](#)
- [Lygus Bug in Pulse Crops](#)
- [Pea Aphids in Pulse Crops](#)
- [Pea Leaf Weevil in Pulse Crops](#)
- [Cabbage Seedpod Weevil](#)
- [Diamondback Moth](#)
- [Bertha Armyworm](#)
- [Flea Beetles](#)
- [Pest Monitoring Program](#)