SUNFLOWER INSECTS

Publications	A1331	Sunflower Production (2014)
	E1457	IPM of Sunflower Insect Pests in the Northern Great Plains (2015)
	E823	Banded Sunflower Moth (2019)

BANDED SUNFLOWER MOTH

BSM begin to emerge from the soil about mid-July. Peak activity normally occurs about the last week of July or the first week of August. Moths fly from last year's field to the current year's field. At this time moths congregate around field margins. The moths move to fields during the bud stage, with a preference for the mid-bud stage. Eggs are laid on the back of the bud and the outside of the bracts. The newly hatched larvae move from these sites to the face of the flower and begin feeding on bracts and florets.
Two distinct and separate sampling procedures can be used to estimate the field damage potential from the banded sunflower moth. The first samples for eggs and the second samples for the adult (moth) stage.

Egg Sampling

The potential for banded sunflower moth damage is determined by counting eggs on the outer layer of floral bracts in the field. Because the eggs are very small a magnifier is needed to accurately count the small eggs. We recommend using a head-mounted 3.5X magnifier to leave both hands free for manipulating the bud being observed. Egg counts should be made when most of the plants in the field are at plant stage R3 (distinct bud elongated ¾ inch above the nearest leaf, yellow ray petals not visible). However, to avoid sampling bias, buds should be randomly selected without regard to plant stage. The egg sampling steps include: 1) Divide each side of the field into two sections, 2) Sample the center of each section at 20 feet into the filed from the field edge, 3) Randomly select five buds, 4) From each bud, randomly select six bracts from the outer whorl and count the eggs on each bract, and 5) Average the egg counts from the five buds and then map the average egg counts from each site to a diagram of the field. Next, calculate the economic injury level. The economic injury level (EIL) is the density or number of insects expected to cause damage that is equal to the cost of control. For Banded sunflower moth, EIL is the number of eggs per 6 bracts and considers treatment cost ($/acre), market price ($/lb), and plant population per acre.

$$\textbf{EIL} = \frac{\textbf{Treatment Cost (\$)}}{\textbf{Market Price (\$) x Plant Population x 0.00078}}$$

An **ED Calculator** is available from the North Dakota State University Department of Entomology Web site for automatically calculating the egg EIL and Economic Distance (http://www.ndsu.nodak.edu/entomology/ext.htm). The economic distance is the distance from the field margin that an economic infestation is present based on the egg density. Please obtain a copy of 2006 **Extension Bulletin E823 'Banded Sunflower Moth'** for complete details for determining the EIL, economic distance and timing of treatments.

Adult Moth Sampling during Day

Sampling sites should be at least 75 to 100 feet from the field margins. In monitoring a field, use the X pattern, counting moths on 20 plants per sampling site to obtain the total number of moths per 100 plants. Sampling should be conducted in the late bud stage (R3), usually during mid-July. If treatment is warranted, it should be applied at the R5.1 sunflower plant growth stage (when 10% of head area has disk flowers that are flowering or completed flowering). During the day (late morning to early afternoon) the moths remain quiet, resting on upper or lower surfaces of the leaves of sunflower plants. When disturbed, they flutter from plant to plant. When sampling for moths during day, the decision to treat or not is based on comparing the mean number of adult moths in the field to the EIL for moths. The EIL is the number of moths per head that will, if not managed, result in seed damage with a value equal to the cost of treatment. Use the following formula based on treatment costs, plant population and market price to determine the adult moth EIL for day sampling.

$$\textbf{EIL (moths per 100 plants)} = \left(\frac{\textbf{(Treatment Cost (\$) / Market Price)}}{\textbf{Plant Population}} \right) \textbf{ x 582.9 }) \textbf{ - 0.7}$$

The constants in the formula simplify the calculation and include the amount of loss attributable to each banded sunflower moth larva produced per moth.

Chemical Control and Application Timing: Chemical treatment is directed at the larval stage of the banded sunflower moth which is the actual damaging stage. Once the decision to treat has been made, it is critical to correctly time the spray application to get maximum control. The best sunflower plant stage to treat is the R5.1 growth stage, or when pollen shed is just beginning. This is the time when most banded sunflower moth eggs have hatched and larvae are present, but before the head has seeds forming. At this time the larvae are beginning to feed on the disk flowers, are exposed on the head, and are susceptible to the insecticide treatment. On older plants where the seeds have started maturing, most larvae will be feeding within the seeds or under the protection of the florets and will be protected from the insecticide. By then, much of the feeding damage has already occurred. Application at an earlier growth stage may be warranted if monitoring reveals earlier than normal egg-laying activity. The **banded sunflower moth**, **seed weevil** and the **Lygus bug** have all impacted quality of **confection sunflowers** the past three to four seasons. It is recommended at this time, that **sunflowers grown for these markets be treated a minimum of two times**, once at early flowering and again 5 to 7 days later. With this type of program, a window of protection should be provided to minimize impact from all three of these seed-damaging insect pests.

CUTWORMS

Most damage by cutworms occurs when plants are in the early stage of development. Damage consists of young plants being chewed off slightly below or at ground level. Some cutworm feeding injury may occur on foliage. Cutworms primarily feed at night. When checking fields for cutworms during the day, dig down into soil an inch or two around recently damaged plants; and look for the gray to gray-brown larva.

Threshold: Treatment is warranted when one cutworm or more is found per square foot or there is a 25% to 30% stand reduction observed.

GRASSHOPPERS

In the Northern Plains, grasshopper egg hatch normally begins in late April to early May. Most grasshoppers emerge from eggs deposited in uncultivated ground. Sunflower growers should expect to find grasshopper feeding first along field margins adjacent to these sites. Later infestations may develop when grasshopper adults migrate from harvested small grain fields.

Threshold: The threatening rating is considered the action threshold for grasshoppers. For example, grasshopper control is advised whenever 50 or more small nymphs per square yard can be found in adjacent, non-crop areas, or when 30 or more nymphs per square yard can be found within the field. When 20 or more adults per square yard are found in field margins or 8 to 14 adults per square yard are occurring in the crop, treatment would be justified. Since it is difficult to estimate the number of grasshoppers per square yard when population densities are high, pest managers can use four 180-degree sweeps with a 15-inch sweep net, which is equivalent to the number of adult (or nymph) grasshoppers per square yard.

	Nymphs per square yard		**Adults per square yard**	
Rating	Margin	Field	Margin	Field
Light	25-35	15-25	10-20	3-7
Threatening	50-75	30-45	21-40	8-14
Severe	100-150	60-90	41-80	15-28
Very Severe	200+	120+	80+	28+

Many of the grasshopper infestations in sunflowers will be the heaviest on the field margins. Treating these areas may lessen the total numbers of grasshoppers successfully entering a field.

SUNFLOWER STEM BORER OR LONG-HORNED BEETLE

Adults appear in mid-June to early July in the southern Plains. Emergence continues through August with 50% emerged by mid-July in Texas. Eggs are laid 4-8 days after mating and eggs are deposited singly in leaf petioles. Approximately 50 eggs are laid per female with about one-third viable. Eggs hatch in 6-10 days. Larvae tunnel and feed in the petioles and stem pith and finally move to the base of the plant to overwinter. Larvae develop through 6 instars. In late summer, the mature larvae girdle the inside of the lower stalk or root crown, move below the girdle, and pack frass into the tunnels. Stalks often break at the point of girdling, leaving the larva protected in its frass packed tunnel during the winter. Larvae are cannibalistic and stalks usually harbor only a single larva even though several may have originally hatched in a stalk. There is one generation per year. Host plants include sunflower, soybean, ragweed, and cocklebur. Plant damage due to adult feeding appears to be insignificant, since the scars do not penetrate the cortex nor encircle the stalk. Larval feeding is apparent when stalks lodge at the point of the girdle, about 2.5 to 3.5 inches (7 to 9-cm) above the soil surface.

Scouting Method: None has been developed.

Threshold: None established.

Management: In the southern Plains, later planting dates and fall or winter tillage have reduced sunflower infestations by this pest. Perennial sunflower species are resistant to stalk infestation, indicating the possibility of breeding cultivars resistant to the long-horned sunflower stem girdler. Chemical treatments on soybean and sunflower are ineffective against larvae and were determined to be impractical against adults because of the extended emergence period. When larvae are present in the stalks, plants do not always lodge. Utilizing lower plant populations that encourage thicker stalks may help to reduce damage from lodging. If fields are suspected to be infested, prompt harvesting will limit losses from lodging.

LYGUS BUG (TARNISHED PLANT BUG)

Lygus bug is primarily an insect pest concern in confection sunflowers. The damage has been named “kernel brown spot” because of the dark spot on the kernel. All evidence suggests the problem is due to feeding by lygus on the developing seed. Lygus are noted for being a pest of seed production to many crops. Their feeding preference is meristematic tissue, embryonic tissue or new growth of any kind. Lygus insert their mouthparts into the host, start a "pre-digestion pump" to inject saliva and start digestion, and then suck the fluid into the stomach. This is where the seed injury originates. The saliva is toxic to plant tissue, helping reduce the plant fluid into a digestible source. The result in sunflower seeds is the brown to black spot resulting from tissue death at that feeding site.

To minimize the damage which results in a quality reduction, a general approach to protecting sunflower from lygus and other seed feeding insects is being recommended. Sunflower is susceptible to lygus damage during flowering, from anthesis through seed hardening. A number of insecticides labeled for controlling head feeding insects in sunflower are available. Of these, the organophosphate (Lorsban) and pyrethroid (Asana XL, Baythroid XL, Warrior II) insecticides are labeled for control of lygus on numerous other crops. Lygus can be treated at the same time confection sunflower is treated for other insects, such as the seed weevil and banded sunflower moth.

Treatment Guidelines

***Confection*:** Entomologists found that populations of adult Lygus bugs at levels of 1 per 9 heads could result in economic loss to the producer through the reduction of seed quality. As a result, two treatments are needed to sufficiently protect confection sunflower heads from insect feeding: one application at the onset of pollen shed, or approximately 10% bloom, followed by a second treatment 7 days later. This program should adequately control insects on confection sunflower throughout flowering, minimizing the potential feeding damage.

***Oilseed*:** Oilseed sunflowers are not believed to be at risk to damage from Lygus feeding at this time.

SUNFLOWER BEETLE

Sunflower beetles begin feeding shortly after they emerge from overwintering. Emergence starts in mid-May. Most feeding by the adults is concentrated on the true leaves. Adults quickly begin laying pale yellow eggs singly on stems and the underside of leaves. Eggs hatch in about 8 days. The pale green, humpbacked larvae begin feeding, eating holes throughout the leaf. Larvae do not feed during the day, resting in the plant tops where they are easily observed.

Thresholds

***Adults*:** Treatment is recommended when scouting determines that an average of 1 to 2 beetles per plant can be found throughout the field.

***Larvae*:** When an average of 10 to 15 larvae per plant is found, defoliation levels of 25% to 30% would be expected. Treatment is suggested when damage levels reach this point and most larvae are 1/4 inch in size.

SUNFLOWER MIDGE

The midge is a small tan fly, 3/32 inch in length. The midge emerges in early July. They prefer to lay eggs on developing buds 1 to 2 inches in diameter. The cream to yellowish-orange larvae feed on bract tissue at first and later on the flowers and seeds. When populations are low and feeding is confined to the bracts, damage results in little economic loss. At higher populations, seed production is reduced or prevented. This type of injury appears as twisted and gnarled flowers. Often, infestations will be limited to field margins. When populations are large, damage may extend into the field and significant field losses may be observed. Historically, infestations and losses have increased with increased sunflower production. Also, environmental conditions contribute to midge outbreaks. Good soil moisture in the month of June promotes survival and emergence of midge.

Threshold: There are no effective chemical controls currently recognized for this pest. The best management strategy has been **rotation** to crops other than sunflower in the vicinity of large infestations. Staggering **planting dates** to promote different budding periods between fields can reduce the risk of damage to all fields in the same geographic areas. Late planting dates (June) also mitigate sunflower midge damage.

SUNFLOWER MOTH

The sunflower moth migrates to North Dakota from Southern states. Because of the migratory nature of the insect, it has not been a major problem in North Dakota. This grayish-tan moth moves into fields in early bloom. It deposits its eggs on the face of the flower. Damage is similar to that caused by the banded sunflower moth. Since female moths lay eggs on the face of sunflower heads, insecticide should be applied in early flowering (R5.1 - R5.3). Pheromone traps are available commercially for monitoring sunflower moths from R5.1 (early flowering) through R5.8 (80% pollen shed). Hot temperatures and high winds may impact the performance of pheromone traps in the field.

Threshold: For field scouting, 1 to 2 moths per 5 plants is necessary for treatment. For pheromone traps, an average of 4 moths per trap per day is needed for an insecticide application. If traps catches are less than 1 moth per trap per day, the infestation is considered non-economic.

SUNFLOWER SEED WEEVIL

The red sunflower seed weevil begins to emerge in early July and continues until mid-August. Peak emergence occurs in late July. Start counting adult seed weevils when the yellow ray petals are just beginning to show. Counts should continue until the economic threshold level has been reached or most plants have reached 70% pollen shed. A plant that has reached 70% pollen shed has few seeds still suitable for red seed weevil egg laying. Fields where most plants are at the 70% pollen shed stage should no longer be susceptible to further significant damage. When sampling, use the X pattern and begin counting at least 70 to 100 feet into the field to avoid field margin effects. Count the number of weevils on five plants at each site for a total of 25 plants. The ideal plant stage for treatment is when most individual plants are at 40% pollen shed. However, we recommend that treatment be considered when three out of 10 plants are just beginning to shed pollen.

Thresholds

***Oilseed Sunflower*:** The threshold can be calculated using the following formula:

$$\textbf{Threshold (weevils per head)} = \frac{\textbf{Cost of Insecticide Treatment}}{\textbf{(Market Price x 21.5) x (0.000022 x Plant Population + 0.18)}}$$

Example for calculating threshold: Price for Oilseed Sunflowers = $0.19						
Plant Population	**Treatment Cost ($)**					
	6.00	**7.00**	**8.00**	**9.00**	**10.00**	**11.00**
17,000	3	3	4	4	4	5
18,000	3	3	3	4	4	5
19,000	2	3	3	4	4	5
20,000	2	3	3	4	4	4
21,000	2	3	3	3	4	4
22,000	2	3	3	3	4	4
23,000	2	2	3	3	4	4
24,000	2	2	3	3	3	4
25,000	2	2	3	3	3	4

Estimation of absolute red sunflower seed weevil adults when sampling using a commercial formulation of mosquito repellent.					
Number counted in the field	Absolute number	Number counted in the field	Absolute number	Number counted in the field	Absolute number
1	1.4	7	12.4	13	23.1
2	2.9	8	14.2	14	24.9
3	4.4	9	16.0	15	26.6
4	5.8	10	17.8	16	29.3
5	7.3	11	19.5	17	31.1
6	10.7	12	21.3	18	32.9

Confection or Hulling Sunflower Market. Red sunflower seed weevil control on confection sunflower is based on a need to keep seed damage below 0.5% due to industry standards. Treatment is recommended when 1 to 2 weevils are found per plant. The **banded moth**, **seed weevil** and the **Lygus bug** have all impacted quality of these sunflowers the past three to four seasons. It is recommended at this time that **sunflowers grown for these markets be treated a minimum of two times**, once at early flowering and again 5 to 7 days later. With this type of program, a window of protection should be provided to minimize impact from all three of these seed damaging insect pests. Growers should plan treatment schedules early. When flowers begin blooming across the region, competition for access to aerial applicators increases.

SUNFLOWER STEM WEEVIL

The sunflower stem weevil can cause serious stalk breakage. This occurs when 25 to 30 larvae are present in a stalk, weakening the stalk when larvae make their overwintering cells in the stalk's base. Breakage is most likely to occur during drought stress or high winds.

The sunflower stem weevil is 3/16 inch in length, and grayish-brown with varying shaped white spots on the wing covers. The weevils emerge in mid to late June. Eggs are deposited in epidermal tissue of the stem. If controls are directed at the adults in order to minimize egg laying, treatments should be initiated during the first few days in July. About 50% of the eggs will be deposited by this weevil by mid-July. Scouting for these insects is difficult due to their size, coloration and habit of "playing dead." Examine 5 plants each at 5 locations and keep a record of the number of weevils found. Approach plants carefully to avoid alarming the weevils, causing them to drop to the ground. Scout from late June to mid-July.

Threshold: Treat for sunflower stem weevils when scouting determines that an average of 1 adult per three plants is found.

WIREWORMS

To decide whether wireworms are a potential problem, refer to the discussion in the corn insects section. Cruiser and Gaucho 600 are labeled as commercial seed treatment and use decisions must be made at time of seed purchase. Please see the seed treatment section in the introduction for more information.

INSECTICIDES REGISTERED FOR USE IN SUNFLOWER

INSECTICIDE	PRODUCT PER ACRE	PHI	Banded Sunflower Moth	Cutworms	Grasshoppers	Longhorned Beetle	Lygus Bugs	Sunflower Beetle	Sunflower Moth	Sunflower Seed Weevil	Sunflower Stem Weevil	Wireworms
Bacillus thuringiensis												
Biobit HP	0.5 - 1 lb	None							●			
Dipel DF	0.5 - 1 lb											
Xentari DF	0.5 - 2 lbs											
Bacillus thuringiensis												
Dipel ES	1.5 - 2.5 pts	None	●						●			
beta-cyfluthrin												
Baythroid XL *RUP*	0.8 - 2.8 fl oz	30 days	●	●	●			●	●	●	●	
carbaryl												
Sevin 4F	1 - 1.5 qts	60 days for seed		●				●	●		●	
Sevin XLR Plus	1 - 1.5 qts	30 days for grazing or forage										
chlorantraniliprole												
Coragen	3.5 - 5 fl oz	21 days	●						●			
Prevathon	14 - 20 fl oz											
chlorantraniliprole + lambda-cyhalothrin												
Besiege *RUP*	5 - 10 fl oz	45 days	●	●	●			●	●	●	●	
chlorpyrifos												
Lorsban 15G	8 oz per 1,000 row-feet	7 days		●								
chlorpyrifos												
Chlorpyrifos 4E AG	PPI[1]:	42 days										
Govern 4E	2 - 4 pts	Do not allow grazing in										
Hatchet		treated areas										
Lorsban 4E	Foliar:											
Lorsban Advanced	1 -2 pts		●	●	●		●	●	●	●	●	
Nufos 4E												
Vulcan												
Warhawk												
Whirlwind												
Yuma 4E *RUP*												
chlorpyrifos + lambda cyhalothrin												
Cobalt Advanced *RUP*	6 - 38 fl oz	45 days Do not allow grazing in treated areas	●	●	●		●	●	●	●	●	
chlorpyrifos + zeta-cypermethrin												
Stallion *RUP*	3.75 - 11.75 fl oz	42 days Do not allow grazing in treated areas	●	●	●	●		●	●	●	●	
cyantraniliprole												
Exirel	7 - 20.5	7 days	●	●					●			
cyantraniliprole												
Fortenza[3]	0.1 - 0.2 mg ai per seed or 0.56 – 1.1 fl oz per 100,000 seeds	None. Consult label for rotational crop restrictions.		●								●
cyfluthrin												
Tombstone	0.8 - 2.8 fl oz	30 days	●	●	●			●	●	●	●	
Tombstone Helios *RUP*												
deltamethrin												
Delta Gold *RUP*	1 - 1.5 fl oz	21 days	●	●	●			●	●	●	●	
esfenvalerate												
Asana XL *RUP*	5.8 - 9.6 fl oz[2]	28 days	●	●	●			●	●	●	●	

INSECTICIDE	PRODUCT PER ACRE	PHI	Banded Sunflower Moth	Cutworms	Grasshoppers	Longhorned Beetle	Lygus Bugs	Sunflower Beetle	Sunflower Moth	Sunflower Seed Weevil	Sunflower Stem Weevil	Wireworms
gamma-cyhalothrin												
Declare *RUP*	0.77 - 1.54 fl oz	45 days	●	●	●			●	●	●	●	
imidacloprid												
Dyna-Shield Imidacloprid 5	12.8 fl oz per cwt	45 days										●
Gaucho 600												
Senator 600FS												
lambda-cyhalothrin												
Grizzly Too	0.96 - 1.92 fl oz	45 days										
Kendo	1.92 - 3.84 fl oz											
Lambda-Cy	1.92 - 3.84 fl oz											
LambdaStar	1.92 - 3.84 fl oz											
Lambda-T	1.92 - 3.84 fl oz											
Lamcap	1.92 - 3.84 fl oz											
Nufarm Lambda-Cyhalothrin 1EC	1.92 - 3.84 fl oz		●	●	●			●	●	●	●	
Paradigm VC	1.92 - 3.84 fl oz											
Province	1.92 - 3.84 fl oz											
Silencer	1.92 - 3.84 fl oz											
Silencer VXN	1.92 - 3.84 fl oz											
Warrior II *RUP*	0.96 - 1.92 fl oz											
thiamethoxam												
Cruiser 5FS	0.25 mg active ingredient per seed	None						●				●
zeta-cypermethrin												
Mustang Maxx *RUP*	At Planting: 4 fl oz	30 days		●								●
zeta-cypermethrin	Foliar Application:	30 days										
Mustang Maxx *RUP*	1.28 - 4 fl oz		●	●	●	●		●	●	●	●	

RUP = Restricted Use Pesticide

● = Control

[1] = PPI applications of chlorpyrifos products for control of cutworms only

[2] = For sunflower beetles only, a lower rate is available - 1.45-5.8 fl oz per acre of esfenvalerate

[3] = May provide protection against wireworm when combined with Cruiser 5FS