INSECT CONTROL

STEM WEEVILS

that scouting begin at '600 degree days' and continue to mid-July. In the Northern Plains, scouting should begin in the 10- leaf stage and continue to mid-July

Management: Sunflower stem weevil can be controlled by Furadan 4F at planting time or with foliar insecticides when the threshold level is reached. The challenge in using foliar insecticides is scouting. Delayed planting can be successful. In the High Plains, planting after 500 degree days have been reached is recommended. In North Dakota a late-May to early June planting window is suggested, while in South Dakota the window extends to mid-June. Delayed planting, however, can result in potentially lower yields due to immaturity at harvest. Reducing the plant population to gain thicker stalks is another management scheme. The thicker stalk may withstand lodging. Tillage is another option, but that door is quickly closing with recognized negatives with tillage. There are hybrid differences, and seed companies may recommend one or more hybrids with 'tolerance' to the stem weevil.

LONGHORNED BEETLE (DECTES)

Life Cycle: Adults appear in mid-June to early July in the High Plains. The adults have an extended period of activity in the field. Eggs are laid on leaf petioles. The hatched larvae tunnel into the stalk to feed. Mature larvae girdle the inside of the base of the stalk and overwinter. There is one generation per year. Other host plants include soybean, cocklebur and ragweed.

Damage: An infested plant is susceptible to lodging, breaking off at its base and making harvesting of the downed plant nearly impossible.

Economic Thresholds: There are no thresholds established.

Scouting Method: None established.

Management: This insect does not appear to be of economic consequence unless the infested plant lodges. According to KSU research, early or at least timely harvest is the best management tool. Lodging is more likely when plants are under 10% seed moisture. Delayed planting has not proven to be a management tool. Field observation and research indicates a thick stalk will withstand lodging. In years with adequate soil moisture, stalks are larger and lodging is less likely. Insecticide control of the adult has not been efficacious due to the extended emergence period. The larvae are well protected in the stalk, and insecticide treatment has not proven efficacious.

LONGHORNED BEETLE

BANDED SUNFLOWER MOTH

Life Cycle: The adults emerge from local overwintering sites rather than migrating long distances. In the northern states, the banded moths begin to emerge about mid-July and are present until mid-August. Adults tend to congregate in field margins or adjacent crops during the day and then move into the sunflower crop in the evening. Within a week after emergence, they begin to lay eggs on the outside of the bracts. Eggs may be found through early August and hatch in five to eight days. Larvae develop through five instars and are present in sunflower heads from mid-July to mid-September. After feeding to maturity, larvae drop to the ground to overwinter.

Damage: Newly hatched larvae move from the bracts (where they feed initially) to the florets of the head, where they enter open florets to feed. During later stages, the larvae tunnel though the base of the floret into the seed and consume the contents. Each larva may destroy five to seven seeds. Silken webbing on the face of the head at maturity indicates the presence of the larvae within the head.

BANDED SUNFLOWER MOTH

Scouting: Sampling plans have been developed using both adult and egg counts. Adult moth and egg counts should be made when most of the plants are at the stage R-3. A low-power magnifier is recommended for egg counts. The new sampling system for adult moths should be conducted during the day (late morning or early afternoon). The moths remain quiet, resting on upper or lower surfaces of the leaves of sunflower plants during the day. When disturbed, they flutter from plant to plant. For details on adult moth and egg scouting and economic thresholds, go to Banded Sunflower Moth E-823 (Revised) — http://www.ag.ndsu.edu/pubs/plantsci/pests/e823w.htm

Control: The economic threshold level has changed with the recent high prices. When monitoring for adults during daylight hours, one banded moth per 100 plants was a reasonable threshold with the high 2008 sunflower market prices. For egg counts, the threshold level in 2008 was two to three eggs per six bracts. Chemicals should be applied from the late bud stage (R4) to early bloom (R5.1). Border spraying can be an option. Spraying in early morning or late evening is preferred to minimize the impact on pollinators. Some common control mistakes are: not scouting; waiting too long to spray; and perimeter spraying only and not scouting the field interior.

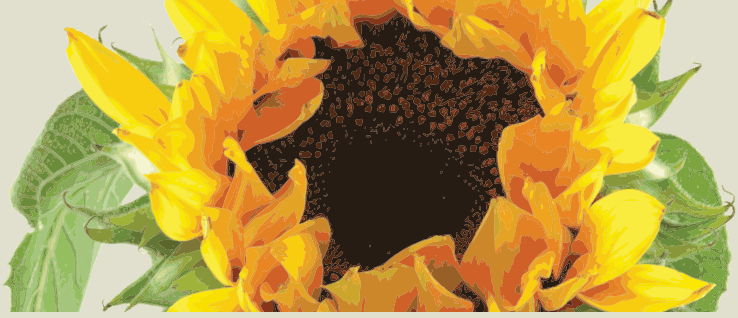
SUNFLOWER MOTH

Economic Threshold: One to two adults per five plants at onset of bloom or within seven days of the adult moth's first appearance. Adults are migratory and usually appear in early to mid-July. Larvae tunnel in seeds from late July to late August.

Scouting: Scouting is most accurate in the early morning or late evening, when moths are active.

Common Errors: Waiting too long to spray during flowering is a common error. If populations are present, the decision to spray an insecticide should be made during R-5.1-5.3. Too often the applicator is delayed or weather conditions are not conducive for aerial application. A delay such as this can cause considerable loss.

Avoid spraying during peak foraging activity of



SUNFLOWER MOTH

pollinators during mid-morning to late afternoon. Spraying during the heat of the day can also cause a reversion of the spray, thus keeping it from penetrating the sunflower canopy. The best time to spray during hot weather is early evening.

SUNFLOWER MIDGE

Life Cycle: Adults overwinter in the soil and emerge in June and July in the North Dakota/Minnesota/Manitoba region. The adults live for only a few days and are difficult to find. They lay eggs in the bracts, and the larvae feed on the edges of the head and migrate into the center of the head as it develops. The larvae mature and drop to the soil and overwinter. A second generation occurs in August.

Damage: Damage is usually sporadic and localized on field margins. In severe infestations, the plat bud may not fully develop or the head becomes gnarled and twisted, resulting in significant yield reduction.

SUNFLOWER MIDGE

Economic Thresholds: None established.

Scouting Method: None established.

Management: Chemical controls are not available. Rotation and varied planting dates are good management tools. Some hybrids are more tolerant to midge damage. USDA and NDSU have conducted hybrid resistance trials for many years. Producers seeing increasing damage in field margins should consider planting the most tolerant hybrids available the following year.

RED & GRAY SEED WEEVILS

Life Cycle: Weevils usually emerge in late June and early July. Once the plant is flowering and making pollen, the weevils feed on the pollen for several days before laying eggs in the developing seeds. The eggs hatch and the larvae consume part of the developing kernel. The larvae then burrow out of the seed and drop to the ground and prepare for overwintering.

Damage: Red seed weevil larvae consume a portion of the kernel before dropping out of the seed. Gray seed weevil larvae generally consume the majority of the kernel before dropping out. The infested gray weevil seeds are generally blown out

RED SEED WEEVIL

of the combine. However, that is not the case of for the red weevil. Damaged confection seeds are discounted, and most contracts have a minimum percent of infestation allowable. This is not the case for oil-type sunflower; however, it is likely that the farmer is losing test weight and yield.

Economic Thresholds: For confection sunflower, one weevil per head is the economic threshold. NDSU has developed a formula that considers price, cost of treatment and plant population.

Recent higher prices foroilseed sunflower have lowered thresholds for red seed weevil. Typically, we are at six to eight weevils per head for the economic threshold; however, thresholds were only at two to three weevils per head in 2008 due to the high prices for sunflower.

Scouting Method: Like most insects, field borders generally will have higher weevil numbers, so it is important to move deeper into the field. Scouting should begin in the R-3 and R-4 (bud) stages and continue to R-5.7. At the bud stage, the weevils tend to feed and hide among the bracts. An easy way to get them to emerge is spray a mosquito repellent containing Deet on the face of the heads. The same can be used when the buds have opened.

Management: There are many effective insecticides labeled for the adult weevils. Since the red seed weevil adults need to consume pollen before laying eggs, spraying at early pollen shed when about 30% of the plants are at R-5.1 is recommended. It is recommended that confections be sprayed even earlier, and two sprays may be warranted depending on populations. The timing of control of the red seed weevil is well suited for controlling both the banded and the sunflower moth. For the gray weevil, spraying at early bud stage R-2 is recommended. However, gray weevil populations have historically been low and no control has been required.

Common Mistakes: Waiting too long to scout and take control measures are historically the most common mistake with the red seed weevil.

SUNFLOWER BEETLE

Life Cycle: There is one generation of the sunflower beetle. Adults overwinter and emerge in the spring and begin to feed. Eggs are laid on the sunflower stem and the underside of leaves.

Damage: The sunflower beetle is a defoliator. De-

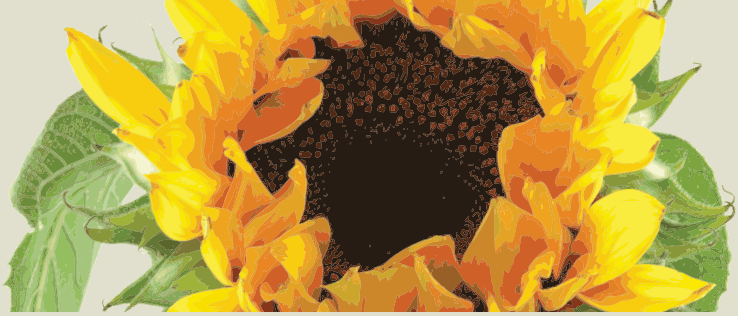
SUNFLOWER BEETLE

foliation of the entire early leaves can have a negative yield impact. Later feeding by the larvae can be severe, leading to reduced yield and poor seedset. The damage to mature leaves creates a 'lace-like' appearance. The sunflower plant can withstand a considerable amount of defoliation without a yield impact.

Economic Thresholds: Sunflower can tolerate more damage as the plant matures. One to two adults is the recommended threshold level in the seedling (two- to six-leaf stage) or 10 to 15 larvae during the later stages or when 25% defoliation occurs in the upper leaves.

Scouting Method: The standard X pattern is recommended. Adults and/or larvae should be counted on 20 plants at five different sites within a field. Or, plant defoliation should be considered using the same process.

Management: Sunflower beetle damage has been largely eliminated by insecticide seed treatments with Cruiser® and Idol®. Most insecticides labeled for sunflower include the sunflower beetle and are very effective.



QUICK REFERENCE GUIDE TO SUNFLOWER INSECTICIDES (Most are Restricted Use Pesticides)

	BANDED MOTH	SUNFLOWER MOTH	SUNFLOWER SEED WEEVIL	SUNFLOWER STEM WEEVIL	SUNFLOWER BEETLE	CUTWORM	GRASS-HOPPER	WIREWORM
Bacillus thuringiensis (for organic production)		●						
beta-cyfluthrin (Baythroid XL)	●	●	●	●	●	●	●	
cabaryl (Sevin)				●	●	●	●	
carbofuran (Furadan 4F)	●	●	●	●	●		●	
chlorpyrifos (Chlorpyrifos 4E AG, Lorsban 4E, Lorsban Advanced, Warhawk, Yuma 4E)	●	●	●	●	●	●	●	
chlorpyrifos + gamma-cyhalothrin (Cobalt)	●	●	●	●	●	●	●	
cyfluthrin (Tombstone)	●	●	●	●	●	●	●	
deltamethrin (Delta Gold)	●	●	●	●	●	●	●	
esfenvalerate (Adjourn, Asana XL)	●	●	●	●	●	●	●	
gamma-cyhalothrin (Proaxis)	●	●	●	●	●	●	●	
imidacloprid (Dyna-Shield, Gaucho 600)								●
lambda-cyhalothrin (Lambda-Cy, Silencer, Taiga Z, Warrior, Kaiso 24 WG)	●	●	●	●	●	●	●	
methyl parathion		●						
thiamethoxam (Cruiser)								●
zeta-cypermethrin (Mustang Max EC)	●	●	●	●	●	●	●	

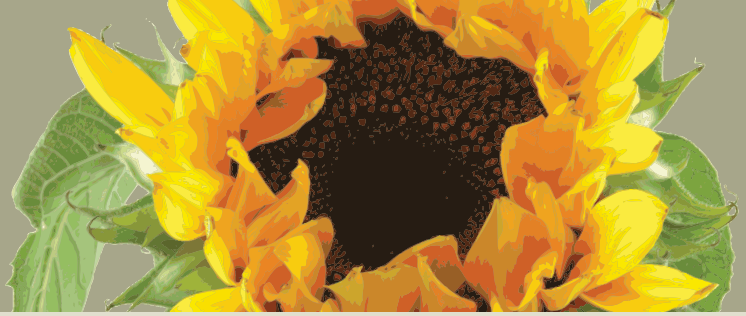
SUNFLOWER HEAD INSECT SCOUTING TIP

JOHN GAVLOSKI

To help get an idea of insect pests that might be hidden in the face of a sunflower head, John Gavloski, entomologist with Manitoba Agriculture, Food and Rural Initiatives, Carman, likes to use a white metal bowl. Vigorously shake a sunflower head against the inside of the bowl – the white color of the bowl makes it easier to see the little critters that might shake loose.

STAGES OF SUNFLOWER DEVELOPMENT

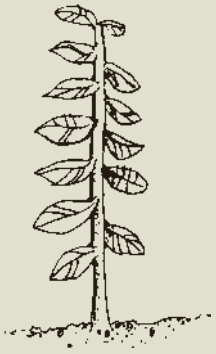
A.A. Schneiter, Professor, J.F. Miller, USDA-ARS, and D.R. Berglund, NDSU Extension Agronomist
NDSU Extension Service



Vegetative Stages

True leaf - 4 cm

V-E



V-12

V-2

V-4

Vegetative Emergence (VE) -- Seedling has emerged and the first leaf beyond the cotyledons is less than 4 cm long.

Vegetative Stages (V-number, i.e. V1, V2, V3, etc.) -- These are determined by counting the number of true leaves at least 4 cm in length beginning as V1, V2, V3, V4, etc. If senescence of the lower leaves has occurred count leaf scars (excluding those where the cotyledons were attached) to determine proper stage.

Reproductive Stages

- R1 The terminal bud forms a miniature floral head rather than a cluster of leaves When viewed from directly above the immature bracts form a many-pointed star-like appearance.
- R2 The immature bud elongates 0.5 to 2.0 cm above the nearest leaf attached to the stem. Disregard leaves attached directly to the back of the bud.
- R3 The immature bud elongates more than 2.0 cm above the nearest leaf.
- R4 The inflorescence begins to open. When viewed from directly above immature ray flowers are visible.
- R5 (R5-decimal, i.e. R5.1, R5.2, R5.3, etc.) This stage is the beginning of flowering. The stage can be divided into substages dependent upon the percent of the head area (disk flowers) that has completed or is in flowering. Ex. R5.3 (30%), R5.8 (80%) etc.
- R6 Flowering is complete and the ray flowers are wilting.
- R7 The back of the head has started to turn a pale yellow color.
- R8 The back of the head is yellow but the bracts remain green.
- R9 The bracts become yellow and brown. This stage is regarded as physiological maturity.

From Schneiter, A.A., and J.F. Miller. 1981. Description of Sunflower Growth Stages. Crop Sci. 21:901-903.

2 cm = 0.8 inches
4 cm = 1.6 inches

Reproductive Stages

R-1

R-2

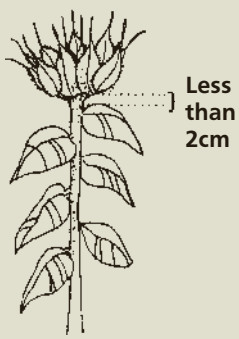
R-3

R-3 Top View

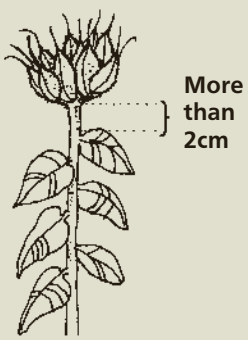
R-4 Top View

R-5.1

R-5.5



R-2



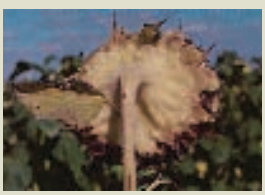
R-3

R-5.9

R-6

R-7

R-8



R-9