

Insect Management in Dry Edible Bean

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In North Dakota and northwestern Minnesota, the most problematic insect pests of dry edible beans are potato leafhopper, seedcorn maggot and grasshoppers. Spider mites are damaging to dry bean during hot, dry conditions, which favor mite populations.

Occasionally, various caterpillars infest bean plants and can cause some defoliation but usually not enough to warrant insecticide treatments. For example, thistle caterpillar infestations can result in defoliation of young plants, particularly in areas of fields where Canada thistle has recently been sprayed with herbicides. This may prompt an insecticide treatment to reduce caterpillar numbers. Figures 52 to 80 at the end of this publication provide photographs to identify insects and damage caused by insects.

Estimating Insect Feeding Damage

In dry edible bean, field scouting to assess insect populations is based on the number of insects per foot of row, number of insects per plant or the level of defoliation.

Insects per foot of row are determined by shaking plants over the inter-row space on which a strip of cloth has been laid. Count the total number of insect pests per foot of row that fall on the cloth.

The percent of defoliation is determined by estimating the amount of leaf loss based on visual inspection of randomly selected plants. The growth stage of the plant is important. Under most conditions, moderate defoliation early in the season has little effect on final bean yield. As plants reach the flowering and pod filling stages, defoliation poses a greater threat to yield.

Bean Aphid

(Hemiptera: Aphidae: *Aphis fabae* Scopoli)

The bean aphid has not been a major pest in North Dakota. It is nearly black and $\frac{1}{8}$ inch long. Bean aphids feed along stems and on the underside of leaves.

Infestations may result in a buildup of honeydew on leaf surfaces, promoting the growth of a black “sooty” fungus. Bean aphids also vector the bean common mosaic virus and bean yellow mosaic virus.

No guidelines for pest management of thresholds have been established in North Dakota.

Armyworm

(Lepidoptera: Noctuidae: *Pseudaletia unipuncta* (Haworth))

Armyworms are greenish brown with pale and dark longitudinal stripes. Fully grown larvae are smooth, striped and almost hairless. Armyworms feed for three to four weeks. When fully grown, larvae are $1\frac{1}{2}$ to 2 inches long. Armyworm larvae have six growth stages, or instars. The final instar lasts about 10 days, and they consume large amounts of plant material during that time.

Armyworms are inactive during the day, resting under plant trash and clumps of grass or lodged plants. They feed at night or on cloudy days, crawling up on plants and consuming foliage. Due to their habit of feeding at night, armyworms may go undetected until significant damage has occurred.

Armyworms do not overwinter in the region. Moths migrate from southern states in late spring and early summer. This helps explain the sporadic infestations that occur. When moths arrive, they prefer to lay their eggs in moist, shady areas, usually where grasses have lodged. Infestations that develop within bean fields are often due to grassy weed problems.

Armyworms are more of a problem in small grains and corn. Damage to dry bean can occur when the armyworms' usual host plants become exhausted due to feeding or dry conditions. When their food is depleted in the hatching site, the armyworms may move in large numbers or "armies," eating and destroying plants or crops in their path.

Threshold

Control of armyworms is recommended when **25 to 30 percent of the foliage is destroyed or if significant injury to pods is evident.**

Bean Leaf Beetle (Coleoptera: Chrysomelidae: *Cerotoma trifurcata* (Förster))

This beetle can vary from yellow to reddish brown, and usually has four spots with a central triangle and a black border on the wing covers. Adults emerge from overwintering sites and move into bean fields as the seedlings emerge. The white larvae develop in the soil, feeding on the roots and nodules. Feeding injury to leaves appears as small, round holes between the leaf veins. New adults emerge in late July and

August, and feed on foliage and pods. The injury to pods results in secondary infections by fungi and bacteria, causing rotting and discoloration.

Threshold

Due to the low incidence of this insect in North Dakota, no local control guidelines have been developed. University of Missouri entomologists suggest treatment when 40 to 70 percent of the bean plants show feeding injury on one or more of the pods per plant.

Cutworms

(Lepidoptera: Noctuidae)

Several cutworm species affect regional crops. The dingy cutworm, *Feltia jaculifera* (Guenée), overwinters as a partially grown larva and is one of the first cutworm species to cause problems during crop emergence from early to mid-May. Dingy cutworm females lay eggs on sunflower heads from mid-July through September. Dry bean and other crops following sunflower in rotation are at greatest risk of injury by dingy cutworm.

Redbacked cutworm, *Euxoa ochrogaster* (Guenée), and the darksided cutworm, *Euxoa messoria* (Harris), overwinter as eggs, which hatch in mid to late May. Eggs are laid in the fall and survive in weedy and reduced-tillage areas. Feeding injury by these cutworms normally occurs in late May to early June.

Most damage by cutworms occurs when bean plants are in the early stages 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 bean fields for cutworms during the day, dig down into soil an inch or two around recently damaged plants; there you can find the gray to brown larva.

Threshold

Treatment is warranted **when one cutworm or more is found per 3 feet of row and the larvae are small (less than $\frac{3}{4}$ inch long).**

Foliage Feeding Caterpillars

Green Cloverworm, Cabbage Looper, Velvetbean Caterpillar, Thistle Caterpillar and Alfalfa Webworm

These caterpillars are sporadic and populations are typically low in North Dakota, with minimal treatment necessary. Sampling for these insects is accomplished by placing a drop cloth or a vertical beat sheet between two rows of plants. Dislodge the larvae from the plants and count those on the cloth to arrive at an estimate of the number per foot of row.

Green Cloverworm

(Lepidoptera: Erebidae: *Hypena scabra* (Fabricius))

These caterpillars are green with two narrow, white stripes down the side. When mature, the caterpillars are $1\frac{1}{4}$ inches long. These caterpillars have only three pairs of fleshy prolegs on the abdomen, plus the pair on the posterior end. Green cloverworm caterpillars move by arching the middle of the body, or “looping.”

Young worms scrape leaf tissue, creating a transparent skin, or “window,” on the leaf surface. Older cloverworms eat holes in the leaves.

Cabbage Looper

(Noctuidae: *Trichoplusia ni* (Hübner))

These caterpillars are light to dark green, with lighter-colored stripes along the sides and top running the length of the body. When mature, the caterpillars are 1½ inches long. These caterpillars have only two pairs of fleshy prolegs on the abdomen, plus the pair on the posterior end. Cabbage loopers move by arching the middle of the body, or “looping.” Cabbage loopers feed on leaves on the interior and lower portion of the plant. As defoliation occurs, caterpillars feed higher in the plant. Feeding injury is similar to what the green cloverworm causes.

Velvetbean Caterpillar

(Noctuidae: *Anticarsia gemmatalis* (Hübner))

This insect does not overwinter in North Dakota. Instead, moths migrate from southern locations. These caterpillars have dark lines bordered by light-colored, narrower lines running the length of the body. The background color ranges from a pale yellow green to brown or black. Velvetbean caterpillars have four pairs of fleshy prolegs, which help to distinguish them from green cloverworm and the cabbage looper caterpillars. Young velvetbean caterpillars feed on the underside of the leaves in the upper portion of the plant. Older larvae consume the entire leaf except for the leaf veins.

Thistle Caterpillar

(Nymphalidae: *Vanessa cardui* (Linnaeus))

This caterpillar is the larva of the Painted Lady butterfly. This butterfly does not overwinter in the region but migrates from southern locations each spring. Thistle caterpillars are brown to black, with yellow stripes along each side of the body. They are covered with scoli (fleshy structures) that give the caterpillar a prickly appearance. Fully grown larvae are about 1½ inches long. The caterpillars feed on the leaves, webbing them together at the feeding site.

Alfalfa Webworm

(Crambidae: *Loxostege cereralis* (Zeller))

These caterpillars are 1 inch long when fully grown and feed for about three weeks. They are greenish to nearly black, with a light stripe that runs down the middle of the back. They have three dark spots, each with hairs, on the side of each segment. Infestations are characterized by light webbing over the leaves. The larvae feed beneath the web, consuming the leaves. These larvae move very rapidly, forward or backward, when disturbed.

Threshold for foliage feeding caterpillars:

Control of these different caterpillars normally is not warranted until greater than 30 percent of the foliage is destroyed. This usually requires an average infestation of 10 to 15 larvae per foot of row.

Grasshoppers (Orthoptera: Acrididae)

In the northern Plains, the grasshopper egg hatch normally begins in late April to early May. Most grasshoppers emerge from eggs deposited in uncultivated ground. Bean growers should expect to find grasshoppers feeding first along bean field margins adjacent to these sites. Later infestations may develop when grasshopper adults migrate from harvested small-grain fields. Grasshoppers will attack leaves and pods. Due to these migrations, bean fields become sites for significant egg laying.

Thresholds

“Threatening” is considered the action threshold for grasshoppers. Because estimating the number of grasshoppers per square yard is difficult 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.

Table 21. Grasshopper rating and number of nymphs and adults.

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

Potato Leafhopper (Hemiptera: Cicadellidae: *Empoasca fabae* (Harris))

Potato leafhoppers do not overwinter in the region. Adult leafhoppers migrate from southeastern states during the spring and early summer. Large numbers of adults may appear early in the season if weather conditions favor their migration into North Dakota. Adult potato leafhoppers can move from cut alfalfa fields, a preferred host, to dry bean fields quickly.

The adult is $\frac{1}{8}$ inch long, wedge-shaped and pale green. Adults are very active, jumping or flying when disturbed. Nymphs are wingless. Adults and nymphs will run backward or sideways rapidly. Nymphs usually complete their growth on the leaf where they hatched, feeding on the underside of the leaf. Because nymphs are not as mobile as adults, they are regarded as the more damaging life stage to the bean plant.

Damage by leafhoppers is referred to as “hopper burn.” Damage is the result of leafhopper saliva that is injected into the phloem tissue in the leaf during feeding. Foliage becomes dwarfed, crinkled and curled. Small triangular brown areas appear at the tips of leaves, gradually spreading around the entire leaf margin.

Threshold

Potato leafhoppers typically are found on the underside of leaves. When counting leafhoppers, cup your hands under the leaves and leafhoppers

will move to the upper leaf surface for easier counting. The threshold for spray decisions is when an average of **one leafhopper per trifoliolate leaf** is found. Do not let infestations and damage progress to the point that yellowing of foliage is easily detected.

Seedcorn Maggot

(Diptera: Anthomyiidae: *Delia platura* (Meigen))

The larvae of seedcorn maggot attack bean seeds, which weakens seedlings and may even prevent germination. The yellowish-white maggot is found burrowing in the seed or emerging stem. The adult flies emerge in spring when soil temperatures reach 50 F. They deposit eggs in soil with abundant organic matter and decaying crop residue, or on the seed or seedling. Seedcorn maggots are usually most severe in wet, cold springs and on high organic-matter soils. Tillage performed just prior to planting has been shown to attract flies to these sites for egg laying.

Thresholds

When conditions are wet and cool or planting into high crop-residue conditions, seed treatments will provide the best defense against infestation and injury.

Two-spotted Spider Mites

(Acari: Tetranychidae:

***Tetranychus urticae* (Koch))**

Spider mites are small and magnification is required to see them. A quick sampling procedure to determine whether mites are present is to hold a piece of white paper below the leaves and gently beat them to

dislodge the mites. The mites appear as tiny dust specks; however, they will move after being knocked off the leaf. Feeding damage by mites first appears as small yellow spots (stippling). As feeding activity increases, leaves become yellow, bronzed or brown and eventually shed from the plant. Mite webbing may be present on plants as mites balloon on webs to disperse among plants and between fields.

Mites usually become a problem when hot, dry weather occurs. Infestations typically are noted first near field edges. Dry conditions stress the plants, whether mites are present or not. If conditions continue, treating for mites is no guarantee plants will recover. In addition, products labeled for mite control often do not give adequate control, and the population of mites may rebound quickly to pretreatment levels or higher. When rain and humidity are present, natural reductions in mite populations occur due to infection by a fungal pathogen. Conditions that are good for the development of pathogens are temperatures cooler than 85 F, with at least 90 percent relative humidity for 12 to 24 hours.

Threshold

Deciding whether to treat is difficult. No specific threshold has been developed for two-spotted spider mite in dry edible bean. Sample plants at least 100 feet into the field and walk in a "U" pattern, sampling two plants per location at 20 different locations. A general action threshold

is to treat when the lower one-fourth to one-third of the canopy has mite damage symptoms and/or mites present (Source: University of Minnesota, Ostlie and Potter).

Remember to use an organophosphate insecticide (for example, Dimethoate) rather than a pyrethroid insecticide to avoid flaring mite populations.

However, the active ingredient bifenthrin (a pyrethroid) does not flare mite populations and provides control. Reasons for the increase in mite populations from some pyrethroids include: disruption of the natural enemies that control spider mites (predatory mites), increased movement of mites out of fields and increased reproductive rates of female mites. Early detection facilitates timely and effective rescue treatments.

Insecticides provide short-term protection, maybe seven days, from the spider mites. Fields will need to be monitored continually for resurging populations. The efficacy of an insecticide can be improved significantly with sufficient water coverage (greater than 18 GPA [gallons per acre]) by ground and 3 to 5 GPA by air and application at high pressure to penetrate foliage.

For insecticide-resistance management of mites, do not apply the same class of insecticide (or mode of action) more than twice, and alternate the class of the insecticides (or mode of action) to prevent buildup of insecticide-resistant mite strains.

Wireworms **(Coleoptera: Elateridae)**

Wireworms are most likely to be problems when dry bean follow pasture or grassland. Infestations often are found in coarse-textured soils (sandy loam) where moisture is abundant, perhaps in low spots of fields.

Thresholds

No easy way exists to estimate wireworm infestations. The following are two methods used:

1. **Soil sampling:** Sample 20 well-spaced 1-square-foot sites to a depth of 4 to 6 inches for every 40 acres being planted. If an average of one wireworm per square foot is found, treatment would be justified.
2. **Solar baiting:** In September, establish bait stations for two to three weeks before freezeup. Place bait stations randomly through the field but representing all areas of the field. You should have 10 to 12 stations per 40 acres. Place 1 cup of wheat and 1 cup of shelled corn in a 4- to 6-inch-deep hole. Cover the grain with soil and then an 18-inch-square piece of clear plastic. Dig up the grain and surrounding soil after one to two weeks or leave until spring. If an average of one or more wireworm larvae is found per station, treatment would be justified.

Seed Treatment

Insecticide seed treatments should be applied as commercial or on-farm application for managing wireworms in dry beans.

Table 22. Insecticides registered for use in dry edible beans.

Insecticide	Product per Acre	Preharvest Interval	Aphids	Armyworms	Bean Leaf Beetle	Caterpillars	Cutworms	Grasshoppers	Leafhoppers	Seedcorn Maggot	Spider Mites	Wireworms
abamectin Agri-Mek 0.15EC	8 - 16 fl oz	Seven days										
acephate Acephate 75WSP Acephate 90 Prill Acephate 90 WDG Acephate 97 Acephate 97UP Orthene 97	0.33 - 1.33 lb 4.4 oz - 1.1 lb 4.4 oz - 1.1 lb 0.25 - 1 lb 0.25 - 1 lb 0.25 - 1 lb	14 days Do not feed treated vines or hay										
Bacillus thuringiensis ssp. kurstaki Biobit HP XenTari DF DiPel DF DiPel ES	0.5 - 2 lbs 0.5 - 2 lbs 1 - 2 lbs 1 - 4 pts	None		‡								
beta-cyfluthrin Baythroid XL (RUP)	0.8 - 3.2 fl oz	Seven days Do not feed treated vines or hay	†	‡								
beta-cyfluthrin + imidacloprid Leverage 360 (RUP)	2.4 - 2.8 fl oz	Seven days Do not feed treated vines or hay		‡								
bifenthrin Bifenture EC Brigade 2EC Fanfare 2EC Sniper Tundra EC (RUP)	1.6 - 6.4 fl oz 1.6 - 6.4 fl oz 1.6 - 6.4 fl oz 1.6 - 6.4 fl oz 1.6 - 6.4 fl oz	14 days										
bifenthrin Capture LFR (RUP)	3.4 - 6.8 fl oz 0.2 - 0.39 fl oz per 1,000 linear feet	14 days										

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bifenthrin + imidacloprid Brigadier Swagger (RUP)	3.8 - 5.6 fl oz 7.6 - 11.2 fl oz	14 days										
bifenthrin + zeta-cypermethrin Hero (RUP)	4.0 - 10.3 fl oz	21 days										
carbaryl Sevin 4F Sevin XLR Plus Sevin 80S	0.5 - 1.5 qts 0.5 - 1.5 qts 0.625 - 1.875 lbs	21 days										
chlorpyrifos Lorsban 50WSP (RUP)	COMMERCIAL SEED TREATMENT ONLY	None										
chlorpyrifos Chlorpyrifos 4E AG Govern 4E Hatchet Lorsban 4E Lorsban Advanced Nufos 4E Warhawk Yuma 4E (RUP)	Preplant broadcast: 2 pt At-plant T-band: 1.8 fl oz per 1,000 linear feet at 30-inch row spacing	None										
chlorantraniliprole Coragen	3.5 - 5 fl oz	One day										
chlorantraniliprole + lambda-cyhalothrin Voliam Xpress (RUP)	5.0 - 8.0 fl oz	21 days Do not graze or harvest vines for forage or hay										
cyfluthrin Renounce 20WP Tombstone Tombstone Helios (RUP)	1 - 4 oz 0.8 - 3.2 fl oz 0.8 - 3.2 fl oz	Seven days Do not feed treated vines or hay	†	‡								

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dimethoate Digon 400 Dimate 4E Dimethoate 400 Dimethoate 4E Dimethoate 4EC	0.5 - 1 pt 0.5 - 1 pt 0.5 - 1 pt 0.5 - 1 pt 0.5 - 1 pt	No PHI Do not feed vines										
esfenvalerate Adjourn Asana XL (RUP)	5.8 - 9.6 fl oz	21 days Do not graze or feed treated vines										
flubendiamide Belt SC	2 - 3 fl oz	14 days Three days for forage and hay										
gamma-cyhalothrin Declare Proaxis (RUP)	1.02 - 1.54 fl oz 2.56 - 3.84 fl oz	21 days Do not graze or feed treated vines										
imidacloprid Attendant 600 Dyna-Shield Imidacloprid 5 Gaucho 600 Senator 600FS	COMMERCIAL SEED TREATMENT ONLY 1.6 - 3.2 fl oz per cwt	None										
imidacloprid Enhance AW	5 oz per cwt	Do not graze or feed livestock on treated area for 60 days after planting										
imidacloprid Impulse 1.6F Nuprid 1.6F Pasada 1.6F Prey 1.6F Sherpa	Foliar application: 3.5 fl oz	Seven days										

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imidacloprid Advise 2FL AmTide Imidacloprid 2F Couraze 2F Macho 2FL MANA Alias 2F Montana 2F Nuprid 2F Nuprid 2SC Widow	Soil applications: 16.0 - 24.0 fl oz	21 days										
imidacloprid Advise 2FL AmTide Imidacloprid 2F Couraze 2F Macho 2FL Nuprid 2SC	Foliar application: 2.8 fl oz	Seven days										
imidacloprid Couraze 4F Mana Alias 4F Montana 4F Nuprid 4F Max Wrangler	Soil applications: 8.0 - 12.0 fl oz	21 days										
imidacloprid Couraze 4F Mana Alias 4F Montana 4F Nuprid 4F Max	Foliar application: 1.4 fl oz	Seven days										
imidacloprid Admire Pro Nuprid 4.6F Pro	Soil applications: 7.0 - 10.5 fl oz	21 days										
imidacloprid Admire Pro	Foliar application: 1.2 fl oz	Seven days										
imidacloprid Malice 75WSP	0.9 oz	Seven days										

Insecticide	Product per Acre	Preharvest Interval	Aphids	Armyworms	Bean Leaf Beetle	Caterpillars	Cutworms	Grasshoppers	Leafhoppers	Seedcorn Maggot	Spider Mites	Wireworms
lambda-cyhalothrin Grizzly Z Lambda-Cy EC LambdaStar Lambda-T Lamcap Nufarm Lambda-Cyhalothrin 1EC Province Silencer Silencer VC Taiga Z Warrior II (RUP)	1.92 - 3.84 fl oz 1.92 - 3.84 fl oz 1.28 - 1.92 fl oz	21 days Do not graze or harvest vines for forage or hay										
malathion Fyfanon ULV Malathion ULV	8 fl oz	One day Do not graze or feed vines, straw or hay										
methomyl Lannate LV (RUP)	0.75 - 3 pts	14 days										
methoxyfenozide Intrepid 2F	4 - 8 fl oz (early season) 8 - 16 fl oz (late season)	Seven days										
naled Dibrom 8 Emulsive (RUP)	1 - 1.5 pts	One day										
novaluron Rimon 0.83EC	6 - 12 fl oz	One day		‡	‡	‡						
phorate Phorate 20G Thimet 20G Thimet 20G SmartBox Thimet 20G Lock n Load (RUP)	4.5 - 7.0 oz/1,000 ft of row – minimum 30-inch spacing Do not allow granules to contact seed	60 days										

Insecticide	Product per Acre	Preharvest Interval	Aphids	Armyworms	Bean Leaf Beetle	Caterpillars	Cutworms	Grasshoppers	Leafhoppers	Seedcorn Maggot	Spider Mites	Wireworms
spinosad Blackhawk Entrust Spintor 2SC Success	2.2 - 3.3 oz 1.25 - 2 oz 4 - 6 fl oz 4 - 6 fl oz	28 days Do not feed forage or hay										
spinetoram Radiant SC	4 - 8 fl oz	28 days										
spirotetramat Movento	4 - 5 fl oz	Seven days										
thiamethoxam Cruiser 5FS CruiserMAXX	1.28 fl oz per cwt 3 fl oz per cwt	None										
zeta-cypermethrin Mustang Max Mustang Max EC Respect (RUP)	At-plant T-band or in-furrow application: 4 fl oz	None										
zeta-cypermethrin Mustang Max Mustang Max EC Respect Respect EC (RUP)	1.28 - 4 fl oz	21 days										

RUP = Restricted-use Pesticide

■ = Control

† = Pea aphid suppression only

‡ = Control of early instar larvae only