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G90-974 The Beaf Leaf Beetle in Soybeans (Revised September 1994)

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The Bean Leaf Beetle in Soybeans

The identification and life cycle of the bean leaf beetle are discussed along with scouting techniques, economic thresholds, and cultural control tactics.

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The bean leaf beetle is a common insect found in Nebraska soybean fields. The insect also feeds on peas, snap beans, and dry beans. Although present in alfalfa and sweet clover in the early spring before soybean emerges, the insect is not known to damage either legume.

Use integrated pest management (IPM) when planning how to reduce bean leaf beetle damage. Integrated pest management is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks. Economic risks can be minimized by using approved bean leaf beetle scouting techniques and economic thresholds to make management decisions. Health risks can be minimized by avoiding pesticide use and by following all safety directions provided on pesticide labels when chemical intervention is needed. Environmental risks can be minimized by avoiding pesticide use when possible and by following all environmental or wildlife safety guidelines provided on the pesticide label when pesticides must be used. Information on planting date effects and new economic thresholds will aid in bean leaf beetle management.

Identification and Life Cycle

Adults vary in color, but are usually reddish to yellowish-tan. They are about 1/4 inch long and commonly have two to four black spots and a black outside border on each wing cover (*Figure 1a*).

These spots and the black border may be missing or less pronounced (*Figure 1b*). However, in all cases there is a small black triangular-shaped coloration at the base of the wing covers near the thorax (*Figures 1a & 1b*).

Figure 1. Adult bean leaf beetles: a) typical adult and b) atypical adult. Note darkened triangular shaped marking at base of wings.

The bean leaf beetle overwinters as an adult in various habitats around soybean fields and seems to prefer leaf and plant litter in woodlands. Beetles begin emerging from these overwintering sites in early April, mate, disperse to weeds and shrubs growing along ditches, roadsides, etc., and eventually move to spring legumes such as alfalfa and sweet clover. They move into soybeans as soon as plants have emerged and occasionally feed on newly germinated plants as they emerge through the soil surface.

These beetles, called colonizers, feed on the developing leaves and cotyledons and begin laying eggs. The eggs are laid in the upper two inches of soil, usually within three inches of the plant stem. A female normally lives about 40 days and lays 125 to 250 eggs. As egg laying is completed the colonizing population begins to die.

Eggs hatch in 4-14 days, depending on soil temperature. Larvae live in the soil and have three instars. Considering an average soil temperature of 70°F, larvae develop to pupae in about 23 days. Warmer soil temperatures can shorten larval development time.

Larvae are whitish and clearly segmented, have three pairs of legs and a brown head and a brown anal plate. They are approximately 3/8 inch long when fully grown. Pupation takes place in an earthen cell and is completed in about a week. The beetles subsequently emerge from the soil.

Total developmental time from egg to adult normally ranges from 25 to 40 days. There are two generations per year in Nebraska. *Figure 2* shows the seasonal occurrence and periods of peak defoliation and pod injury by the two generations of bean leaf beetle.

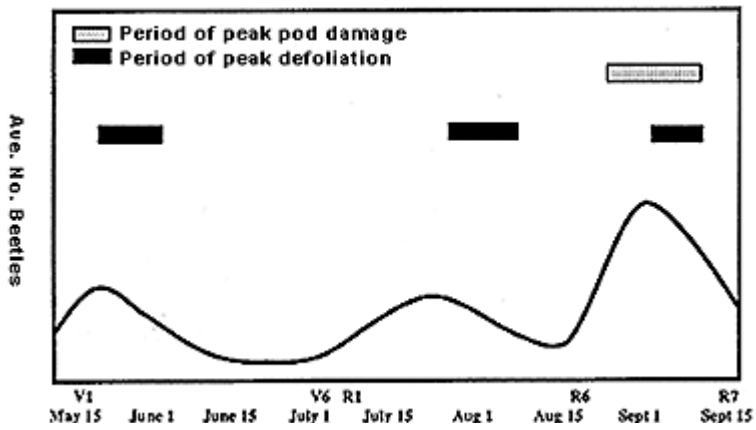

Figure 2. Typical seasonal incidence of the bean leaf beetle (solid black line) and peak times of defoliation and pod feeding (shaded areas). The V1 through V6 stages represent the pre-reproductive vegetative growth stages of the soybean plant. The R1 through R7 stages represent the flowering and pod developmental stages of the plant. R1 - R2 refer to bloom, and R3 - R7 refer to the developing pod and seed.

Injury and Damage

Bean leaf beetle adults and larvae have chewing type mouthparts and feed on soybeans in several ways:

1. Adults feed on the leaves causing defoliation (*Figures 1a & 1b*) and on the pods causing scarring (*Figure 3*);
2. larvae feed on the roots and root nodules below ground level.

An inverse relationship between defoliation and seed yield has been documented in Nebraska: as defoliation increases, seed yield decreases.

Figure 3. Soybean pod showing typical feeding damage by the bean leaf beetle.

The effects of pod damage are twofold. Pod damage can decrease seed yield and reduce seed quality. Damaged pods are predisposed to secondary infection by bacteria and fungi which may cause rotting and discoloration. Infections may increase in severity during periods of cool and wet weather. However, research done in Iowa indicates that economically significant reductions in seed yield normally occur at lower beetle densities than that which would cause economically significant seed quality reductions. Consequently, economic injury levels for seed yield loss are of most importance to growers.

Bean leaf beetles are known to transmit bean pod mottle virus, cowpea mosaic virus, and southern bean mosaic virus; however, no economic damage from any of these viruses has been reported in Nebraska.

Bean leaf beetle larvae feed on the roots and root nodules. Although this feeding can reduce nitrogen fixation, its economic importance remains unclear.

Cultural Control

Soybean planting date has a significant impact on spring colonization of soybean by bean leaf beetle and subsequent beetle population dynamics. Early planting (before mid-May) and emergence of soybeans attracts colonizers and offers an ideal environment throughout the egg-laying period of the colonizing population. Therefore, a mid-May or later planting may minimize the initial colonizing population of beetles. This in turn may reduce subsequent generations, although it must be remembered that beetles may migrate into the field from surrounding areas.

The soybean varieties available in Nebraska are not resistant to bean leaf beetle damage.

Sampling

The IPM philosophy assumes insect and mite pests may be present in all cropping systems, and that some plant damage can be tolerated. Indeed, some level of a pest population is required to maintain a robust population of predators and parasites. It is essential to scout fields regularly because management decisions are based in part on insect densities, and beetle populations can change rapidly. Fields should be scouted at least once a week during times of bean leaf beetle activity to assess plant damage, correctly identify the pest, and get "a feel" for population changes.

Bean leaf beetle activity varies during the day. Activity patterns suggest the best sampling times are

around mid-morning or in the afternoon. Try to avoid sampling during low or high temperature extremes. Perhaps more importantly, maintain a similar sampling time in each field to eliminate variability.

During the seedling stage, direct observation is the preferred sampling technique. A seedling soybean has three or fewer unfolded trifoliolate leaves. After this point it becomes too difficult to see all of the beetles. To use this method, randomly select at least five sampling sites from across the entire field. At each sampling site, slowly walk down 15 to 20 feet of row and carefully count all beetles. Do not disturb the plants, but set close enough so you can see the underside of the leaves. Calculate the average number of beetles per foot of row.

After the soybean plants are too large for direct observation, use either the drop cloth or sweep net sampling techniques.

The drop cloth technique is the most useful method when sampling bean leaf beetles on plants past the seedling stage, even though the insects quickly drop off the plant and run away at initial disturbance. However, it cannot be used in drilled or broadcast seeded soybeans. Equipment consists of an off-white cloth measuring 36 x 42 inches. Staple a thin strip of wood, approximately 1/2 x 1 inch wide, to each long side of the cloth. Randomly select at least five sampling sites from across the entire field. At each site, carefully slide the rolled up drop cloth beneath the canopy and unroll the cloth from one row over to the next row without disturbing the foliage. Next, vigorously shake the plants from both rows over the drop cloth using both hands and forearms. Count the beetles as they hit the cloth. In this way, two 3-row-feet sections (6 feet total) are sampled. Calculate the number of beetles per row-foot. If you cannot identify the insect, collect several specimens for later identification.

The sweep net is another common technique used to collect bean leaf beetles on soybean; however, results can vary considerably because of different methods used by scouts as they walk through the field. Also, small plants cannot be effectively sampled and, conversely, very large, or lodged plants, are difficult to sweep. To use the sweep-net technique, randomly select at least five sampling sites. At each site, walk through the field at a steady, even pace performing about 25 sweeping arcs. The best sweeping action for bean leaf beetle is a consistent upward motion through the foliage, using as much force as needed to move the net smoothly through the foliage. Carefully remove all leaf tissue and debris, count the number of beetles in the net, and calculate the average number of beetles per sweep. If beetle numbers are high, count the beetles after fewer sweeps. Sources for purchasing a standard 15-inch diameter sweep net are listed at the end of this NebGuide.

Table 1. Economic thresholds for bean leaf beetle on seedling (a.,b.) and reproductive (c.) stage soybean, assuming an approximate 36.6 bu/acre yield potential and 30-inch row spacing with approximately seven plants/foot. Numbers in parenthesis (c.) are beetles per sweep for drilled soybean with 7-inch row spacing.

a. VC Economic Thresholds (beetles per plant)				
	Pest-management costs, $/a			
Crop value, $/bu	**6.00**	**8.00**	**10.00**	**12.00**
5.00	3	4	5	6
6.00	3	4	5	5
7.00	2	3	3	4

8.00	2	3	3	4
b. V1 Economic Thresholds (beetles per plant)				
	Pest-management costs, $/a			
Crop value, $/bu	**6.00**	**8.00**	**10.00**	**12.00**
5.00	4	6	7	9
6.00	4	5	6	7
7.00	3	4	5	6
8.00	3	4	5	5
c. R6 Economic Thresholds (beetles per sweep)				
	Pest-management costs, $/a			
Crop value, $/bu	**6.00**	**8.00**	**10.00**	**12.00**
5.00	4(3)	5(4)	6(5)	8(5)
6.00	3(2)	4(3)	5(4)	6(5)
7.00	3(2)	4(3)	4(3)	5(4)
8.00	2(2)	3(2)	4(3)	5(3)

Treatments Guidelines

Treatment guidelines listed in *Table 1a-1c* are economic thresholds. Economic thresholds are the levels where control action should be taken to prevent the insect pest from causing damage valued beyond the cost of control. The value of potential crop damage depends on the potential yield and market value of the crop. Control costs include both insecticide and its application costs.

Economic thresholds are presented for soybeans at selected seedling (V) and reproductive (R) plant stages. The cotyledon stage (VC) is defined as when the first two unifoliolate leaves have unrolled. In other words, the leaflet edges are no longer curled around and touching. Similarly, the V1 stage occurs when the unifoliolate and first trifoliolate leaves are unrolled. The R6 stage (full seed) is defined as when a pod containing a green seed that fills the pod cavity is located at one of the four uppermost main stem nodes with a fully developed leaf. A fully developed leaf is one that has an unrolled leaf at the node just above it.

After the seedling stages and until the reproductive stages, soybean can tolerate substantially more defoliation. Generally, during this period treatment is not recommended unless beetles are present and defoliation reaches 50 percent.

Economic thresholds for reproductive soybeans in stages other than R6 (ie. R4, R7) are probably higher than those for R6 soybean. This is because the pods on plants past R6 are maturing and there is less green pod tissue available for beetle feeding, and plants in early reproductive stages have greater yield compensation potential than those in stage R6 or older.

These economic thresholds were developed assuming conventional wide-row soybean production (30-inch row spacing) with approximately seven plants per foot. Drilled or broadcast soybean fields have different environmental conditions than wide-row fields, so economic thresholds may be different. Because plants in these cropping systems (drilled and broadcast) gather light more efficiently, they may

tolerate more defoliation, and therefore have higher economic thresholds. However, information is lacking at this time, so we recommend using the economic thresholds in *Table 1a-b* until the effects of insect injury to drilled (or broadcast) soybean is better understood. In *Table 1c* use the economic thresholds in parenthesis for drilled soybean production.

When treatment is justified, any one of several insecticides can be used to control bean leaf beetle. Consult the current edition of the publication *EC1511, Insect Management Guide for Nebraska Alfalfa, Soybean, Wheat, Range and Pasture,* for information on insecticides registered for bean leaf beetle control.

Always read insecticide product labels thoroughly and follow all instructions, restrictions and precautions.

All insecticides are toxic to bees, so spraying a blooming bean field can result in high bee mortality. If a field must be treated with an insecticide, we recommend notifying beekeepers with hives within a three-mile radius of the field so the hives can be covered or moved. Also, if possible, apply the insecticide in the evening when most of the bees will have returned to the hive.

Sources for purchasing a sweep net:

1. Bio-quip Products, 17803 LaSalle Ave, Gardena, CA 90248-0620, (310) 324-0620
2. Gempler's, P.O. Box 270, 211 Blue Mounds Road, Mt. Horeb, WI 53572, (800) 382-8473
3. Forestry Supplies, Inc., 205 W. Rankin Street, P.O. Box 8397, Jackson, MS 39284, (800) 647-5368

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