Integrated Pest & Crop Management





# Japanese Beetle Adults Emerge Across Missouri

*By Wayne Bailey*

During the past two weeks Japanese beetle adults began their annual emergence in many Missouri counties. The emergence of this beetle is about 3 weeks earlier than normal with numbers of beetles emerging being substantially greater than in past years. In most areas their numbers will steadily increase through June then slowly decrease through when peak numbers will result in damage to many different tree, ornamental, fruit, and field crops. Adult Japanese beetles typically feed on green silks and tassels in corn, foliage feed on soybean, and damage the foliage and fruit of over 400 flower, shrub, and tree species.

This beetle was first found in the United States in Riverton, New Jersey in 1916, following its accidental introduction from its native country of Japan. It is thought that grubs of this pest were introduced in pots of iris plants imported into the US prior to the initiation of federal plant and animal inspections in 1918. In Missouri, infestations of Japanese beetles were first found in the southern portion of the City of St. Louis in 1934. A Missouri Department of Agriculture bulletin list 51 different tree, shrub, vegetable, and field crop species being damaged by Japanese beetles in St. Louis by the summer of 1936. For many years the Japanese beetle infestation stayed in the St. Louis area although by the early 1960's infestations were reported in the urban centers of Kansas City, Columbia, and Springfield. These urban infestations were initially associated with golf courses and plant nurseries where grubs of this pest were again introduced in soil and plants imported from states with earlier Japanese beetle infestations. Populations of this pest remained mainly in these urban area until about 10-12 years ago, when this pest began spreading mainly west and south into more rural areas of the state. The Japanese beetle in Missouri is still in a colonization stage of population growth with continued dispersal in most counties of the state. At present, most rural areas of Missouri will experience increasing populations of this pest for the next 7 -10 years and maybe beyond. Beneficial biological pathogens and agents will eventually slow these expanding populations, resulting in annual population fluctuations at levels below peak populations experienced in earlier years.

Japanese beetle adults are approximately 1/2–inch in length, metallic green in color with bronze or copper colored wing covers. A diagnostic characteristic is the presence of twelve white tufts of hair or bristles located around the edge of the shell (five running down each side and two located at the very back end). Without magnification, these structures are seen as white dots. Japanese beetles can be confused with adult green June beetle, but are smaller in size. Adult beetles typically begin emerging from the soil in late May or early June, reach peak numbers in June into early July and then diminish during late July into August. Adults emerge, mate and feed for approximately 45 - 60 days. During this time each beetle female typically lays 40 to 60 eggs in groups of 1 to 8 into the soil with larvae emerging in about 2 weeks. Larvae will feed on plant roots and decaying material before overwintering in the soil as 3rd instars (worm or grub stage). The following

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spring larvae quickly finish development, pupate, and emerge as adult beetles beginning in very late May or early June in most years.

Feeding damage of adult Japanese beetle is often observed as a lace-like pattern of defoliation of host plant foliage as beetles avoid leaf veins when feeding. Beetles often gather high (often in full sunlight) on host plants which exude strong odors to feed in high numbers. Several tree species, roses, and mature fruit are favored hosts of this pest. Tassels and developing silks of corn can be severely damaged by adult feeding, whereas leaf feeding is common on soybean and many other plants. Feeding on corn silks can disrupt pollination and result in substantial yield losses. Foliage feeding on soybean is less damaging, although late planted or double-crop soybean may sustain economic damage if beetle numbers are high. The grub stage of this pest will feed on plant roots of both corn and soybean with most feeding occurring after egg hatch in late June, July and possibly early August. Damage to plant root hairs may result in poor uptake of water and nutrients or be more severe and cause reduced stands through plant mortality.

Economic thresholds for corn and soybean can quickly be reached as these beetles often aggregate on host plants and feed in high numbers. In field corn, an insecticidal treatment is justified if during the silking period an average of 3 or more beetles are present per ear tip, silks have been clipped to ½ inch or less in length, and pollination is less than 50% complete. For soybean insecticide treatment is justified if foliage feeding exceeds 20% - 30% prior to bloom and10% - 20% from bloom through pod fill. Use the lower threshold numbers if soybean plants are under drought stress. The following insecticides are recommended for control of Japanese beetles in field corn and soybean in Missouri. Wayne Bailey 573 864-9905 (cell)

### JAPANESE BEETLE Adults - *Popillia japonica* Newman

**Soybean Insect Management - 2012**

Comments: Treat when defoliation reaches or exceeds 30% before bloom and 20% between bloom and pod fill. Thresholds may be lower if plants under drought conditions. Adults often aggregate on host plant to feed.

| Common Name | Trade Name | Rate of formulated material per acre | Placement/Comments | REI Hours | Pre-Harvest Intervals Days |
|---|---|---|---|---|---|
| esfenvalerate | ***Asana XL** | 5.8 to 9.6 fl oz | foliage | 12 | 21 (grain)<br>Do not graze or feed livestock |
| cyfluthrin | ***Baythroid XL** | 1.6 to 2.8 fl oz | foliage | 12 | 45 (grain, feeding dry vines)<br>15 (green forage) |
| bifenthrin | ***Brigade 2EC** | 2.1 to 6.4 fl oz | foliage | 12 | 18 (grain) |
| chlorpyrifos + gamma-cyhalothrin | ***Cobalt** | 19 to 38 fl oz | foliage | 24 | 30 (grain)<br>Do not graze or feed livestock |
| lambda-cyhalothrin + thiamethoxam | ***Endigo ZC** | 3.5 to 4.5 fl oz | foliage | 24 | 30 (grain)<br>Do not graze or feed livestock |
| zeta-cypermethrin + bifenthrin | ***Hero** | 4.0 to 10.3 fl oz | foliage | 12 | 21 (grain)<br>Do not graze or feed livestock |
| Imidacloprid + cyfluthrin | ***Leverage 2.7** | 3.8 fl oz | foliage | 12 | 45 (grain, feeding dry vines)<br>15 (green forage) |
| zeta-cypermethrin | ***Mustang Max** | 2.8 to 4.0 fl oz | foliage | 12 | 21 (grain)<br>Do not graze or feed livestock |
| microencapsulated methyl parathion | ***Penncap-M** | 2 to 3 pt | foliage | 96 | 20 (grain) |
| carbaryl | **Sevin 4F** | 1 to 2 pt | foliage | 12 | 21 (dry grain or hay)<br>14 (graze or forage) |
| zeta-cypermethrin + chlorpyrifos | ***Stallion** | 5.0 TO 11.75 fl oz | foliage | 24 | 28 (harvest) |
| cyfluthrin | ***Tombstone Helios** | 0.8 to 1.6 fl oz | foliage | 12 | 45 (grain, feeding dry vines)<br>15 (green forage) |
| lambda-cyhalothrin | ***Warrior II with Zeon** | 1.60 to 1.92 fl oz | foliage | 24 | 30 (grain)<br>Do not graze or feed livestock |

***Designates a restricted-use pesticide. Use is restricted to certified applicators only.**
**Read the label to determine appropriated insecticide rates. Be sure to follow all label directions, precautions, and restrictions.**

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## Japanese Beetle Adults Emerge Across Missouri

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### JAPANESE BEETLE Adults - *Popillia japonica* Newman

**Corn Insect Management - 2012**

Comments: Treatment of Japanese beetle is justified if 3 or more beetles are present on green silk, silks are eaten to 1/2 inch or less in length, and pollination is less that 50% complete.

| Common Name | Trade Name | Rate of formulated material per acre | Placement/Comments | REI Hours | Pre-Harvest Intervals Days |
|---|---|---|---|---|---|
| esfenvalerate | ***Asana XL** | 5.8 to 9.6 fl oz | foliage | 12 | 21 (grain) |
| cyfluthrin | ***Baythroid XL** | 1.6 to 2.8 fl oz | foliage | 12 | 21 (grain or fodder)<br>0 (green forage) |
| bifenthrin | ***Brigade 2EC** | 2.1 to 6.4 fl oz | foliage | 12 | 30 (grain, fodder, graze) |
| chlorpyrifos + gamma-cyhalothrin | ***Cobalt** | 38 to 42 fl oz | foliage | 24 | 21 (grain or ears)<br>14 (graze or silage haravest) |
| deltamethrin | ***Delta Gold 1.5EC** | 1.5 to 1.9 fl oz | foliage | 12 | 21 (grain, fodder)<br>12 (cut forage or graze) |
| zeta-cypermethrin + bifenthrin | ***Hero** | 4.0 to 10.3 fl oz | foliage | 12 | 30 (grain, stover, graze)<br>60 (forage) |
| zeta-cypermethrin | ***Mustang Max** | 2.72 to 4.0 fl oz | foliage | 12 | 30 (grain, stover) 60 (forage) |
| microencapsulated methyl parathion | ***Penncap-M** | 2 to 3 pt | foliage | 48 | 12 (grain, forage, graze) |
| carbaryl | **Sevin 4F** | 2 to 4 pt | foliage | 12 | 48 (grain or fodder)<br>14 (harvest or graze forage) |
| cyfluthrin | ***Tombstone Helios** | 1.6 to 2.8 fl oz | foliage | 12 | 21 (grain or fodder),<br>0 (forage) |
| lambda-cyhalothrin | ***Warrior II** | 1.28 to 1.92 fl oz | foliage | 24 | 21 (grain), 1 (graze, forage)<br>21 (treated feed or fodder) |

***Designates a restricted-use pesticide. Use is restricted to certified applicators only.**
**Read the label to determine appropriated insecticide rates. Be sure to follow all label directions, precautions, and restrictions.**

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# Weed Science 101:
# Bigger Weeds/Waiting to Spray Means More Yield Loss

*By Kevin Bradley and Brock Waggoner*

Last season, we conducted the first year of a two-year survey to identify the most common weed species encountered in Missouri corn and soybean fields, and also to better understand the management practices that producers utilize for the control of these species. This survey was primarily conducted throughout the northern half of the state across 50 different locations in 2011, and will be conducted in even more locations throughout the state in 2012. In a previous article, we described our results pertaining to the most common weeds that we found in Missouri corn and soybean fields in 2011. In this article, we will explain our findings as it relates to some of the management practices that producers utilize in Missouri soybean production systems.

As one component of this survey, we used the WeedSOFT computer program to estimate soybean yield loss based on the weed species and density of weeds present in each field just prior to the time of the post-emergence herbicide application. WeedSOFT is a program developed by a number of weed scientists at universities throughout the U.S., and is available online free of charge. To use this tool for yourself, simply go to www.weedsoft.org and click on the yield loss calculator. Once there, all you have to do is enter the size and density of weed species in your field, and you will be able to see the yield loss that may have already occurred in your fields, or the weed loss that will occur if you delay your post-emergence herbicide application to subsequent soybean growth stages.

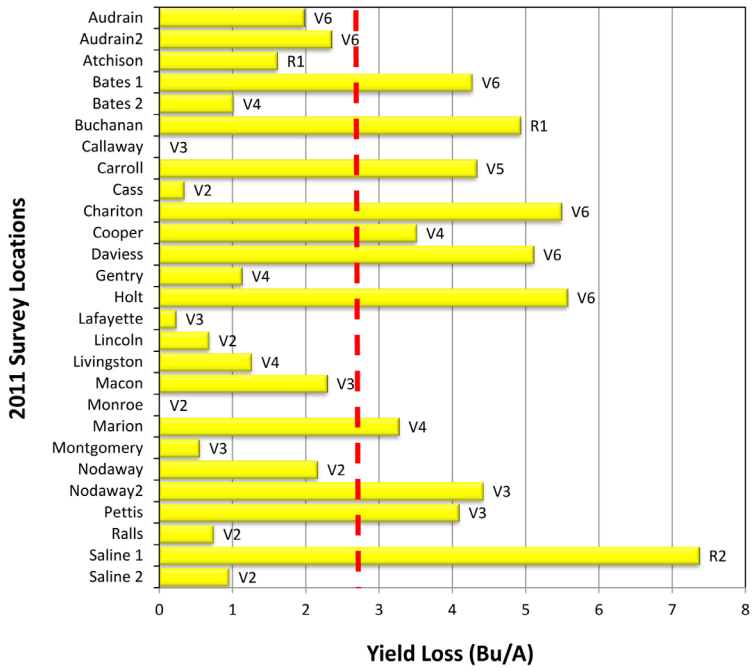


*Figure 1. Estimated soybean yield losses incurred by the time of the first post-emergence herbicide application in the 2011 Missouri survey locations. The dashed red line indicates the average yield loss incurred across all surveyed locations. Labels next to each bar indicate the soybean growth stage at which the post-emergence herbicide application was made.*

As illustrated in Figure 1, based on the weed species and densities present at the time of the post-emergence herbicide applications, we estimated that soybean yield losses ranged from 0 to 7.4 Bu/Acre at the 2011 survey locations. Also, across all the survey locations we were able to determine that the average soybean yield loss incurred as a result of waiting too long to make post-emergence herbicide applications was 2.7 Bu/Acre (Figure 1).

The point of this data is simple; it illustrates that in many Missouri soybean fields we are losing yield as a result of early-season weed competition and waiting too long to make our post-emergence herbicide applications. One of the fundamental principles of weed science is that the more weeds there are and the bigger these weeds get, the more yield loss we will experience. To some extent, this principle is also illustrated in the results from last year's survey contained in Figure 1. Although this figure does not show the weed density at each location, it does show the time that the post-emergence herbicide applications were made. For the most part, herbicide applications made to soybeans in the later stages of growth resulted in higher yield loss than those made at earlier stages of growth.

So, as you consider the timing of your post-emergence herbicide application in soybean this season, consider the price of a bushel of soybeans and what a 2 or even 3 Bu/Acre yield loss means to you. There are plenty of companies promoting various practices that will "enhance" yield by 2 or 3 Bu/Acre; our data indicate that in many Missouri soybean fields, we may be losing this much yield to weed competition.


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# Missouri Cotton Growers -- Beware of Root-Knot Nematodes

*By Allen Wrather*

Crop-threatening levels of root-knot nematodes (RKN) are present in several cotton fields in southeast Missouri. The symptoms of RKN injury will initially be visible 6 to 8 weeks after cotton emergence and may include yellow-green leaf color, stunt, and these plants may wilt more quickly than healthy plants during a hot afternoon. In addition, plants injured by these nematodes will have swollen areas (galls) visible on infected roots from 6 to 8 weeks after emergence to harvest. Farmers and consultants should be cautious about diagnosing the cause of yellow-green leaf color and stunt of midseason cotton because other factors such as low soil pH and drought may cause this, but only RKN causes galls on roots.

We learned from University of Missouri field trials that the best method for detecting the location of yield-robbing RKN in fields is to examine cotton roots for galls soon after harvest. This method was more reliable, more rapid, and less expensive than analysis of soil samples for root-knot nematodes.

Nothing can be done this year to help RKN infected cotton plants. However, cotton farmers can take action to protect their crop against these nematodes during 2013, but their options are limited. There are no cotton varieties highly resistant to these nematodes, and crop rotation is not helpful since these nematodes also attack soybean, corn, and grain sorghum. Growers should consider using a nematicide such as Telone prior to planting next year, or a seed treatment such as Avicta or Aeris. There are advantages and disadvantages to the use of each of these products.

For more information contact Allen Wrather at the University of Missouri Delta Center (Phone: 573-379-5431, E-mail: wratherj@missouri.edu) or check the Delta Center Web Page (aes.missouri.edu/delta).

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# Early Season Soybean Diseases

*By Laura Sweets*

This is another interesting year for early season soybean diseases in Missouri. According to the Missouri Agricultural Statistics Service as of June 10, 2012, "soybeans were 93 percent planted which is 16 days ahead of last year and 23 days ahead of normal. Emergence was 75 percent, 9 days ahead of last year and 15 days ahead of normal. Emergence was reported as uneven across the state." Certainly weather has been a key factor both in the earlier than normal planting and the uneven emergence. After a cool, wet, early start to the season, most of the state has been warm to hot and unusually dry. Sporadic rains have led to crusting problems in some areas. Seed planted into dry seedbeds has either not germinated or germinated and then struggled to emerge and establish a root system in dry soil. For most of the state, several soaking rains would be the best possible solution to this situation.

Although weather is a key factor this season, soil-borne pathogens could still be contributing to some of the uneven stands and poor vigor in seedlings. A heavy rain event and slow emergence due to compaction could have given Pythium species an opportunity to attack developing seedlings. Plants which are struggling to send out roots and to survive could be targets for Rhizoctonia or Fusarium species. And the hot, dry conditions could mean that *Macrophomina* (charcoal rot fungus) might also be causing early season seedling problems. Plants with comprised root systems will be more prone to desiccation from warm, drying winds. Some marginal browning of leaflets, wilting of plants and even premature death of plants may occur in drier areas of fields or across large areas of fields.

Soybean seedling blights have the potential to cause losses in Missouri soybean fields every year. The specific seedling blights that occur and their severity vary with the environmental conditions each season. When checking stands this season, it is important to take into account soil conditions and environmental stress as well as checking for seedling diseases.

*Pythium* and *Phytophthora* are favored by wet conditions and are more likely to be serious problems when wet conditions exist at or just after planting. *Rhizoctonia* and *Fusarium* are not as restricted by soil moistures and soil temperatures but still need some moisture to initiate infection. *Macrophomina phaseolina* grows best at temperatures between 82-95°F. Infection of seedlings with *Macrophomina* is most likely to occur if conditions of high soil temperatures and low soil moisture exist during the first two to three weeks after planting.

Symptoms of *Pythium damping-off* range from seed rot or preemergence damping-off to early postemergence

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## Early Season Soybean Diseases

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damping-off. Affected tissue develops a soft, watery brown rot. Pythium damping-off is most likely to occur in cool (50-550F), wet soils.

*Phytophthora* can cause seed rot, preemergence damping-off and early postemergence damping-off. Initially affected tissue develops a soft, watery brown rot. Within several days the affected plant parts may dry out and shrivel up becoming dark, dry and brittle. This early stage Phytophthora is difficult to distinguish from Pythium damping-off. Phytophthora can also cause a seedling blight in which established seedlings turn yellow, wilt and die. Generally the entire seedling is affected and roots may be poorly developed and rotted. Phytophthora root rot is more likely to occur in heavy, wet soils, low areas or compacted areas, but it may occur in light soils or better drained areas if heavy rains occur after planting.

*Rhizoctonia* can cause seedling blight and root rot of soybean. Affected stands may have an uneven appearance and seedlings appear pale green in color and stunted in growth. The identifying feature of this disease is a small, reddish lesion on one side of the stem at or just below the soil line. This lesion develops into a sunken, cankered area at the point of infection. Sometimes the lesion will expand to completely girdle the stem. On severely infected seedlings, the entire hypocotyl may be discolored and shriveled into a dry, stringy or wiry stem.

*Fusarium* can also cause root rot of soybean. Infection is usually confined to roots and lower stems. The lower part of the taproot and the lateral root system may be discolored, deteriorated or completely destroyed. General roots show a nondescript brown discoloration and a dry, shrunken rot. Above ground portions of plants may appear off-color and stunted. Plants with severe Fusarium root rot may die prematurely.

Charcoal rot, caused by *Macrophomina phaseolina,* may be more commonly recognized as a mid to late season disease on maturing soybean plants, but it can also occur early in the season on seedlings. Infected seedlings tend to show a reddish brown discoloration from the soil line up the stem. The discolored area changes from reddish brown to dark brown to black. Foliage may appear off color or begin to dry out and turn brown. If the growing point is killed, a twin stem plant may develop. Under hot, dry conditions, infected seedlings may die. Under cooler, wetter conditions, infected seedlings may survive but carry a latent infection. Then symptoms may reappear later in the season with hot, dry weather.

Once the crop has been planted, there is little that can be done to reduce incidence or severity of soybean seedling diseases. Additional stress from poor growing conditions, herbicide injury or other factors may compound problems with soybean seedling diseases. Prior to planting it is important to consider variety selection (especially in fields with a history of *Phytophthora*), fungicide seed treatment, crop rotation, seedbed preparation and conditions at planting.

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# Spider Mites Problems Emerging in Dry Areas of State

*By Wayne Bailey*

Two-spotted spider mite problems in soybean began during the past few days. Although recent precipitation in some areas of the state slowed the growth of spider mite populations in field crops, the threat from this pest remains high in most areas of Missouri. Southern Iowa producers have been experiencing problems with this pest in past weeks with most problems in Missouri being reported in counties located adjacent to the Iowa-Missouri border. In Missouri, all areas with dry, dusty conditions are at high risk from spider mites where these conditions prevail. Precipitation in the form of rain or heavy dew conditions often cause two-spotted spider mite populations to collapse within a few hours of being exposed to moisture. However, mite populations can double about every 5-7 days under drought conditions. Spider mite infested fields which receive rainfall should continue to be scouted as damaging levels of spider mite may redevelop if drought conditions return.

Spider mites are small organisms most closely related to chiggers and spiders than to insects. The two-spotted spider mite, Tetranychus urticae, is often an economic pest of soybean and to a much lesser extent of corn in Missouri during periods of drought conditions. This pest gets its name from two dark spots on the sides of the abdomen which are visible through the mite's translucent, greenish-yellow, white, orange, or red colored body. Spider mites feed on the underside of soybean leaves and are difficult to detect due to their small size of about 1/60 of an inch. Damage to soybean is thought to be caused by the mites piercing individual plant cells with their mouthparts and then feeding on cell contents. Spider mites problems in

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## Spider Mites Problems Emerging in Dry Areas of State

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soybean are often first reported when areas of soybean plants begin to yellow along field borders or waterways (where mites often overwinter). Upon inspection of specific plants growing in these yellowed areas, spider mite injury initially appears as yellow stipples, speckling or spots on soybean foliage. In heavy infestations the yellow stipples are generally followed by the injured foliage turning yellow, then brown/bronze and finally dropping from the plant as soybean leaves dry. As mite populations increase, damage moves across the field as mites infest additional soybean plants. Identification of this pest is best accomplished using at least a 10X magnification lens (20X magnification better) or by shaking infested leaves over a white paper and watching for the small yellow mites to crawl about the paper after being dislodged from the soybean plant.

In most years problems with two-spotted spider mites in soybean occur on plants in the reproductive stages of growth during late summer when dry conditions often prevail. This year damage is being found early in the growing season on seedling soybean. A general recommendation for two-spotted spider mite on soybean is to control this pest when foliage yellowing reaches 20% before pod set and when foliage yellowing reaches 10% and mites are present after pod set. In either case, heavy infestations of spider mites can cause severe damage to soybean plants in both vegetative and reproductive stages of growth. Concerns with seedling soybean plants include the small size of soybean seedling at this time in the growing season, the resulting loss in photosynthetic efficiency and possible loss of plant foliage, and the continued exposure to drought conditions. Soybean plants infested during reproductive growth stages often experience increases in both soybean maturity and shattering of grain following economic infestations of spider mites.

Although soybean plants can often compensate later in the season if growing conditions become favorable, treatment of plants in both vegetative and reproductive stages of growth is recommended during drought conditions if yellowing of foliage reaches 20 – 30% with stipples or speckling present of soybean leaves and live mites are present. Infestations of this pest generally move downwind, so it is necessary to scout the entire field to determine if mites are present in spots or throughout the entire field. If hot and dry conditions persist, the entire field may require treatment even if mite numbers are low in some areas of the field. The following insecticides are labeled for control of two-spotted spider mite on soybean. Note that treated soybean plants may continue to exhibit additional damage symptoms for up to 7 - 10 days following removal of spider mites.

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### SPIDER MITES - *Tetranychus urticae* Koch

**Soybean Insect Management - 2012**

Comments: Before pod set, treat when foliage yellowing reaches 20% and mites are present on plants. After pod set, treat when foliage yellowing reaches 10% and mites are present on plants. Spider mite infestations on soybean are often associated with drought conditions.

| Common Name | Trade Name | Rate of formulated material per acre | Placement/Comments | REI Hours | Pre-Harvest Intervals Days |
|---|---|---|---|---|---|
| bifenthrin | ***Brigade 2EC** | 5.12 to 6.4 fl oz | foliage | 12 | 18 (grain) |
| chlorpyrifos + gamma-cyhalothrin | ***Cobalt** | 13 to 26 fl oz | foliage | 24 | 30 (grain)<br>Do not graze or feed livestock |
| dimethoate | **Dimethoate 4EC** | 1 pt | foliage | 48 | 21 (grain) |
| lambda-cyhalothrin + thiamethoxam | ***Endigo ZC (suppresion only)** | 4.0 to 4.5 fl oz | foliage | 24 | 30 (grain)<br>Do not graze or feed livestock |
| zeta-cypermethrin + bifentrhrin | ***Hero** | 4.0 to 10.3 fl oz | foliage | 12 | 21 (grain)<br>Do not graze or feed livestock |
| chlorpyrifos | ***Lorsban Advanced** | 1/2 to 1 pt | foliage | 24 | 28 (grain)<br>Do not graze or feed livestock |
| chlorpyrifos | ***Nufos 4E** | 1/2 to 1 pt | foliage | 24 | 28 (grain)<br>Do not graze or feed livestock |
| lambda-cyhalothrin | ***Warrior II with Zeon** | 1.92 fl oz | foliage | 24 | 30 (grain)<br>Do not graze or feed livestock |

***Designates a restricted-use pesticide. Use is restricted to certified applicators only.**
**Read the label to determine appropriated insecticide rates. Be sure to follow all label directions, precautions, and restrictions.**

## Spider Mites Problems Emerging in Dry Areas of State

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### TWOSPOTTED SPIDER MITES - *Tetranychus urticae* Koch

**Corn Insect Management - 2012**

Comments: Treatment is justified if high mite numbers are causing yellowing or browning of lower plant leaves before dent growth stage of field corn. Do not apply dimethoate during pollen-shed.

| Common Name | Trade Name | Rate of formulated material per acre | Placement/Comments | REI Hours | Pre-Harvest Intervals Days |
|---|---|---|---|---|---|
| bifenthrin | *Brigade 2EC | 5.12 to 6.4 fl oz | foliage | 12 | 30 (grain, fodder, graze) |
| dimethoate | Dimethoate 4EC | 2/3 to 1 pt | Broadcast | 48 | 28 (grain) 14 (forage) |
| zeta-cypermethrin + bifenthrin | *Hero | 10.3 fl oz | Broadcast | 12 | 30 (grain, stover, graze) 60 (forage) |

**Note: See Table 1 for listing of commercial seed treatments**
**See Table 2 for listing of (Bt) trangenic traits. Toxin produced inside plant**
***Designates a restricted-use pesticide. Use restricted to certified applicators only.**
**Read the label and follow all insecticide rate information, directions, precautions, and restrictions.**

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# Soybean Foliage Diseases May Begin to Show Up

*By Laura Sweets*

Again, the 2012 season has been a challenging one for soybean production. Although much of the soybean crop was planted earlier than normal, the unusually dry conditions have led to slow and in some cases uneven emergence. The lack of rain, low relative humidity and high evapotranspiration rate combined with the slow growth of soybean plants has not been conducive to the development of soybean foliage diseases. So far this season, soybean foliage diseases have not been particularly prevalent. There have been a few reports of frogeye leaf spot and some reports of red to purple red discoloration of leaflets which resembles sunburn damage. If conditions continue to be dry, foliage diseases should not be an issue. A change in weather to rain, especially frequent rain or rains with driving winds could result in the appearance of bacterial blight, bacterial pustule, downy mildew, Septoria brown spot and more frogeye leaf spot. In most years the soybean foliage diseases occur in low levels and do not cause significant losses. However, under favorable conditions for disease development, losses can be serious.

**Septoria brown spot** causes small, angular to somewhat circular, red to brown spots on the unifoliolate and lower trifoliolate leaves. The individual spots can run together forming irregularly shaped brown blotches on the leaves. Infected unifoliolate leaves will yellow and drop prematurely. Brown spot usually starts on the lower portion of the plant. Under favorable weather conditions (warm, wet weather), the disease may move up through the plant. Late in the growing season, infected leaves may turn rusty brown or yellow and drop prematurely.

The fungus which causes this disease, *Septoria glycines,* survives in infested residues left on the soil surface. During periods of wet spring weather, spores produced on the residues are splashed or blown to cotyledons or unifoliolate leaves of soybean where they cause infection. Warm, wet weather favors infection and disease development. Symptoms develop over a temperature range of 59-86°F with 77°F being optimum for symptom development. The spread of brown spot is restricted by dry weather. Because the pathogen survives in infested residues left on the soil surface, the disease is more severe in continuous soybean fields.

The principle means of reducing Septoria brown spot is to rotate crops with at least one year between soybean crops. The use of foliar fungicides from bloom to early

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## Soybean Foliage Diseases May Begin to Show Up

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pod development may be warranted in high value fields (ex. seed production fields) or in fields with second year beans. See the *2011 Missouri Pest Management Guide: Corn, Grain Sorghum, Soybean and Winter Wheat M171* for information on fungicides labeled for use on soybeans.

**Bacterial blight** also produces lesions on the leaves. The lesions usually begin as small, angular, yellow lesions. Lesions usually have a translucent or water soaked appearance which may be more easily seen if leaves are held up to the light. Lesions progress in color from yellow to light brown and eventually to a dark reddish brown. Older lesions have a dark center surrounded by a water soaked margin and a yellow halo. In cool, rainy weather the small, angular lesions may enlarge and merge producing large, irregular dead areas in the leaf. With wind and rain these large dead areas drop out or tear away, giving the leaf a ragged appearance. Symptoms typically occur several days after a rain with driving winds or a hail storm. If there are alternating periods of wet and dry weather, plants may show bands of leaves with symptoms, i.e. leaves that expanded during wet periods show bacterial blight symptoms and leaves that expanded during dry periods are free of disease.

Bacterial blight, caused by the bacterium *Pseudomonas savastanoi* pv. *glycinea*, occurs worldwide and is common during cool, wet weather. The causal bacterium may be carried in seed or can survive in crop residues. Bacteria on the seed may cause cotyledon infection. Bacteria can then be spread from infected cotyledons or infested residues by wind driven rain or splashing rain. Further spread occurs during rainstorms and hail storms or during cultivation when plants are wet. During early to mid-season, disease outbreaks usually occur five to seven days after wind driven rains. Hot, dry weather checks disease development.

Management strategies for bacterial blight include planting disease-free seed, avoiding highly susceptible varieties in areas where bacterial blight is serious, rotating crops with at least one year between soybean crops and not cultivating when foliage is wet.

**Bacterial pustule**, caused by the bacterium *Xanthomonas axonopodis* pv. *glycines*, occurs in most soybean-growing areas. Although bacterial pustule can occur in Missouri, it is not founds as frequently as the other foliage diseases. Bacterial pustule is common during periods of warm, wet weather. The causal bacterium may be carried in seed or can survive in crop residues. Bacteria are spread from infested residues or infected plants tissues by wind driven rain or splashing rain. Further spread occurs during rainstorms and hailstorms.

Bacterial pustule lesions begin as small, light-green lesions. Lesions may range from small spots to large areas of brown tissue formed when smaller lesions merge. Initially the center of the lesion may be slightly raised. The raised center or "pustule" may be more evident in older lesions or lesions on the lower leaf surface.

Symptoms of bacterial pustule may appear similar to those caused by bacterial blight. Typically bacterial pustule lesions do not show the water soaking around the lesions that is common with bacterial blight. Also, the small, raised pustules in the center of the lesions are characteristic of bacterial pustule but not of bacterial blight.

The raised center or "pustule" on the lower leaf surface might be mistaken for soybean rust pustules. Bacterial pustules do not produce spores, and they may show cracking or fissures across the pustule rather than the circular openings characteristic of soybean rust pustules. A high-power hand lens may be necessary to distinguish between bacterial pustule and soybean rust when examining leaves in the field.

Management strategies for bacterial pustule include planting disease-free seed, avoiding highly susceptible varieties in areas where bacterial blight is serious, rotating crops with at least one year between soybean crops and not cultivating when foliage is wet.

**Frogeye leaf spot**, caused by the fungus *Cercospora sojina*, occurs worldwide. However, the disease is most serious in warm regions or during periods of warm, humid weather. The fungus that causes frogeye leaf spot survives in infested soybean residue and infected seed. Spores produced on infested residues or infected plant tissues are spread by splashing rain or winds.

*Continued on page 53*

## Soybean Foliage Diseases May Begin to Show Up

*continued from page 52*

Symptoms of frogeye leaf spot occur primarily on leaves, although the causal fungus may also infect stems, pods and seed. Lesions are small, circular to somewhat irregular spots that develop on the upper leaf surfaces. Initially the spots are dark and water soaked in appearance. As the lesions age, the center becomes light brown to light gray in color. Older lesions have a light center with a darker red to purple-brown border. Lesions may merge to kill larger areas of the leaf surface. Heavily spotted leaves usually wither and drop prematurely.

Disease development is favored by warm, humid weather. Leaves that expand and develop during periods of warm, wet weather are more likely to be infected than leaves that expand during dry periods. Dry weather severely limits disease development.

The principle means of reducing frogeye leaf spot are to plant disease-free seed, to select resistant varieties and to rotate crops with at least one year between soybean crops. The use of foliar fungicides from bloom to early pod development may be warranted in high value fields (ex. seed production fields) or in years when weather is especially favorable for disease development. See the *2011 Missouri Pest Management Guide: Corn, Grain Sorghum, Soybean and Winter Wheat M171* for information on fungicides labeled for use on soybeans.

**Downy mildew**, caused by the fungus *Peronospora manshurica*, is reported wherever soybeans are grown. The downy mildew fungus survives as oospores in infected leaf residues and on seeds. Spores produced in diseased areas on lower leaf surfaces are wind-blown and serve to infect additional leaves on that plant or other plants.

Initial symptoms of downy mildew are pale green to light yellow spots or blotches on the upper leaf surface of young leaves. These areas enlarge into pale to bright yellow blotches of indefinite size and shape. Eventually lesions turn grayish brown to dark brown with a yellow margin. During periods of heavy dew or wet weather, a gray to purple fuzz that is visible growth of the downy mildew fungus develops on the lower leaf surface beneath the diseased areas on the upper leaf surface. Severely infected leaves turn yellow and then brown. Downy mildew is favored by high humidity and temperatures of 68-72 degrees F.

Management options for downy mildew include planting disease-free seed and rotating crops with at least one year between soybean crops.

**Sunburn** appears as small, red to dark red spots on both leaf surfaces. In severe cases, the discoloration spreads over and along the leaf veins. There may be a sharp line between discolored tissue and green tissue if leaflets have been shaded by leaflets higher up on the plant or folded so only a portion of the leaf is exposed to the sun. If leaflets have been turned over by the wind, the damage will be more evident on the lower leaf surface. If leaflets haven't unfolded or opened up, damage may be more evident on the lower leaf surface.

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# Weather Data for the Week Ending June 14, 2012

*By Pat Guinan*

| Station | County | Weekly Temperature (ºF) | | | | | | Monthly Precipitation (in.) | | Growing Degree Days‡ | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Avg. Max. | Avg. Min. | Extreme High | Extreme Low | Mean | Departure from long term avg. | June 1-14 | Departure from long term avg. | Accumulated Since Apr.1 | Departure from long term avg. |
| Corning | Atchison | 87 | 63 | 92 | 53 | 76 | +4 | 0.64 | 1.84 | 1262 | +470 |
| St. Joseph | Buchanan | 85 | 61 | 90 | 57 | 74 | +3 | 1.53 | -1.21 | 1144 | +349 |
| Brunswick | Carroll | * | * | * | * | * | * | * | * | * | * |
| Albany | Gentry | 86 | 59 | 92 | 53 | 74 | +3 | 0.64 | -2.01 | 1096 | +337 |
| Auxvasse | Audrain | 85 | 59 | 90 | 51 | 73 | +1 | 0.44 | -1.97 | 1143 | +299 |
| Vandalia | Audrain | 85 | 59 | 91 | 51 | 73 | +1 | 0.74 | -1.68 | 1137 | +343 |
| Columbia-Bradford Research and Extension Center | Boone | 85 | 58 | 90 | 53 | 72 | 0 | 0.63 | -1.72 | 1115 | +236 |
| Columbia-Capen Park | Boone | 88 | 55 | 92 | 48 | 71 | -2 | 0.62 | -2.04 | 1060 | +140 |
| Columbia-Jefferson Farm and Gardens | Boone | 86 | 60 | 90 | 54 | 73 | +1 | 0.49 | -1.90 | 1156 | +275 |
| Columbia-Sanborn Field | Boone | 86 | 62 | 91 | 57 | 75 | +2 | 0.75 | -1.86 | 1247 | +325 |
| Columbia-South Farms | Boone | 85 | 59 | 90 | 54 | 73 | +1 | 0.53 | -1.87 | 1147 | +267 |
| Williamsburg | Callaway | 86 | 58 | 91 | 50 | 73 | +2 | 0.06 | -2.39 | 1149 | +336 |
| Novelty | Knox | 84 | 57 | 89 | 50 | 72 | 0 | 0.33 | -2.00 | 1021 | +230 |
| Linneus | Linn | 85 | 59 | 90 | 50 | 73 | +2 | 0.44 | -2.32 | 1069 | +296 |
| Monroe City | Monroe | 84 | 59 | 90 | 50 | 73 | +1 | 0.67 | -1.49 | 1103 | +273 |
| Versailles | Morgan | 86 | 59 | 90 | 53 | 74 | +2 | 0.55 | -1.73 | 1233 | +303 |
| Green Ridge | Pettis | 86 | 60 | 90 | 54 | 74 | +2 | 0.51 | -2.10 | 1185 | +326 |
| Lamar | Barton | 87 | 61 | 92 | 54 | 75 | +2 | 1.55 | -1.47 | 1272 | +307 |
| Cook Station | Crawford | 87 | 53 | 91 | 45 | 71 | -1 | 0.06 | -2.12 | 1113 | +165 |
| Round Spring | Shannon | 87 | 55 | 92 | 47 | 70 | -2 | 1.07 | -1.00 | 1092 | +196 |
| Mountain Grove | Wright | 82 | 58 | 85 | 49 | 71 | -1 | 1.16 | -0.79 | 1139 | +292 |
| Delta | Cape Girardeau | 86 | 59 | 88 | 53 | 72 | -4 | 1.42 | -0.18 | 1322 | +206 |
| Cardwell | Dunklin | 86 | 64 | 89 | 60 | 74 | -4 | 3.47 | +1.88 | 1506 | +234 |
| Clarkton | Dunklin | 87 | 62 | 9 | 56 | 74 | -3 | 0.53 | -1.24 | 1465 | +232 |
| Glennonville | Dunklin | 87 | 63 | 90 | 57 | 74 | -3 | 0.66 | -0.85 | 1473 | +243 |
| Charleston | Mississippi | 86 | 62 | 89 | 58 | 74 | -2 | 1.91 | +0.12 | 139 | +269 |
| Portageville-Delta Center | Pemiscot | 88 | 65 | 91 | 59 | 76 | -2 | 0.47 | -1.45 | 1556 | +303 |
| Portageville-Lee Farm | Pemiscot | 87 | 64 | 90 | 58 | 75 | -2 | 0.63 | -1.10 | 1526 | +286 |
| Steele | Pemiscot | 88 | 65 | 91 | 60 | 76 | -2 | 3.39 | +1.31 | 1560 | +292 |

‡Growing degree days are calculated by subtracting a 50 degree (Fahrenheit) base temperature from the average daily temperature. Thus, if the average temperature for the day is 75 degrees, then 25 growing degree days will have been accumulated.

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