Plant Protection Programs University of Missouri

Integrated Pest & Crop Management

Big Weeds in Soybean. What Can You Do?

By Kevin Bradley

There hasn't been a lot of variety to the calls I've been getting lately. They have to do with essentially one issue; controlling big weeds in soybean. Either these weeds never got sprayed because of the wet season we've had, or the weeds have already been sprayed one or more times with glyphosate and they are still living. Most of the complaints I've been hearing have to do with waterhemp (as usual), but running a close second this year is giant ragweed. Last year we conducted a phone survey, which indicated that we have at least 200,000 acres of soybean in Missouri infested with glyphosate-resistant waterhemp. At the time, I thought it was a very conservative estimate. Now I know it is.

My answer to these calls has been pretty simple—if you have a field where the weeds (including waterhemp) have gotten tall simply because you haven't been able to get a sprayer across the field and you **DON'T** suspect you have any glyphosate-resistant weeds present, then our research shows that increasing the rate of glyphosate will generally provide as good or better weed control than adding a herbicide tank-mix partner to glyphosate in Roundup Ready soybeans. Unless you have glyphosate-resistant weeds present, most of the available research indicates that the number one factor that influences the level of weed control you will get with glyphosate is the rate you apply. Simply put, the higher the rate, the better the weed control in most cases.

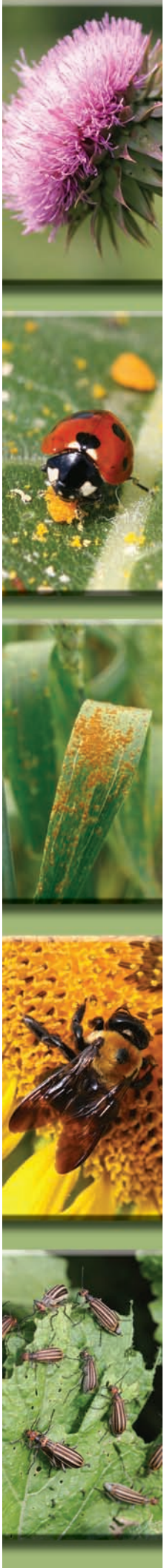
If, however, you suspect that you do have a glyphosate-resistant weed like waterhemp present, then a tank-mix partner can be very beneficial. Increasing the rate of glyphosate in this case will rarely provide better weed control and will almost certainly cost you more money. In our research, we found that a tank-mix of Ultra Blazer at 1.5 pts/A, Flexstar at ¾ pt/A, or Phoenix at 8 ozs/A with glyphosate provided from 77 to 85% control of glyphosate-resistant waterhemp six weeks after treatment. It is important to recognize that this level of control was achieved when these herbicides were applied to 6- to 8-inch tall waterhemp. It is unlikely that you will get this kind of control if you are spraying waterhemp that is much taller than this. Regardless, these herbicides are essentially the last option for suppression or control of glyphosate-resistant waterhemp at this point in the season.

Soybean fields like this one with a waterhemp population that is 4 to 5 feet in height are not an uncommon site this year.

My answer is the same if you suspect you have other glyphosate-resistant weeds like common or giant ragweed. Although for the most part Firstrate and some of the other ALS-inhibiting herbicides still have good activity on common and giant ragweed in Missouri, these herbicides are perhaps even more sensitive to weed height. This means that when the ragweeds get over one foot or so in height, our likelihood of controlling them with these herbicides goes down dramatically. So, we are still left with PPO-inhibiting herbicides like Phoenix in combination with glyphosate and hope we get "burn-back" of these weeds and good canopy closure. Not ideal by any stretch of the imagination, but about the best we can hope for with the conditions we have experienced this year.

Kevin Bradley
BradleyKe@missouri.edu

Table of Contents



Soybean Foliage Diseases May Begin to Show Up

By Laura Sweets

Again, the 2008 season has been a challenging one for soybean production. Wet weather and flooding have led to late plantings and replanting. There is a wide range in growth stages of soybean plants in fields across the state. Soybean foliage diseases have not been particularly widespread or severe so far this season. However, the recent period of wet weather and wind driven rains may lead to the appearance of foliage diseases such as Septoria brown spot or bacterial blight. Frogeye leaf spot, downy mildew and bacterial pustule are the other foliage diseases likely to occur on soybeans during the mid-season period. Soybean rust has developed in Missouri soybean fields three out of the last four years but generally it has come in late in the season so has not caused significant yield losses. See the IPM PIPE web site for current information on soybean rust (www.sbrusa.net). 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 pod development may be warranted in high value fields (ex. seed production fields) or in fields with second year beans. See the *2008 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

Continued on page 89

Corn Foliage Diseases

By Laura Sweets

This has been an "interesting" year for corn and other field crops in Missouri and most of the Midwest. Prolonged periods of wet weather and then flooding delayed planting or led to replanting. Overall the corn crop is behind normal but there is also a wide range in growth stages across the state. We have not received many samples or calls related to corn foliage diseases but with the most recent bout of wet weather, it is likely that corn foliage diseases may begin to show up in fields. Anthracnose was a problem in some fields earlier in the season so it would be prudent to continue scouting for this foliage disease. Gray leaf spot, common rust and southern rust are the other foliage diseases most likely to occur on corn in Missouri. Northern corn leaf blight does not occur every year but may occur in wet or cool, wet years so that would be another foliage disease to look for when scouting fields.

Generally speaking with the corn foliage diseases, the later in the season (especially the longer after pollination) that the foliage disease becomes established, the lower direct yield losses will be. Highest yield losses occur if diseases such as rust or gray leaf spot develop prior to pollination. Also, most of the corn foliage diseases are favored by extended periods of free moisture on the leaf surfaces. This moisture can be from rain, overhead irrigation or heavy dews that stay late in the day. Fields with poor air movement, river bottom fields or shaded portions of fields may also have higher levels of corn foliage diseases.

Most of the control recommendations for minimizing losses due to corn foliage diseases are preventative measures such as planting resistant hybrids, rotating crops so the corn doesn't follow corn in the same field or tillage to reduce the amount of infected residue left on the soil surface. Several fungicides are labeled for use on corn to control foliage diseases. See the *2008 Missouri Pest Management Guide: Corn, Grain Sorghum, Soybean and Winter Wheat M171* for fungicides labeled for use on field corn.

Fields with high levels of various foliage diseases may also show higher levels of stalk rot this fall. As harvest approaches, check fields which have had foliage disease problems for stalk rot and try to harvest problem fields promptly.

Symptoms of Common Corn Foliage Diseases

Anthracnose (Colletotrichum graminicola)

Infection is most common on lower leaves of young plants but may occur on upper leaves of maturing plants too. Anthracnose lesions tend to be brown, spindle-shaped lesions with yellow to reddish-brown borders. Concentric rings or zones are sometimes apparent within the diseased areas. Stalk symptoms appear as black linear streaks on the surface of lower internodes late in the season.

Holcus Leaf Spot (Bacterial leaf spot)

Lesions usually are oval to rectangular in shape. Initially, they are dark-green and water soaked. Later they become dry and turn light brown with a reddish margin. The lesion resembles parchment paper. Holcus leaf spot may occur a few days after a rain storm but does not usually cause serious losses.

Common Rust (Puccinia sorghi)

Circular to elongate, golden-brown to reddish-brown pustules develop on both upper and lower leaf surfaces. As plants mature, the pustules become brownish-black in color. The pustules rupture, revealing powdery brown spores.

Southern Rust (Puccinia polysora)

Light, reddish-brown, circular to oval pustules develop primarily on the upper leaf surface. Eventually pustules rupture to reveal powdery spores. Later a brownish-black spore stage often forms in rings around the initial pustules.

Gray Leaf Spot (Cercospora zeae-maydis)

Lesions on maturing corn are pale brown to reddish-brown and blocky to rectangular in shape when compared to other corn leaf blights. The lesions typically are restricted by leaf veins giving the lesions parallel edges. Older lesions have a gray cast. Lesions may merge, resulting in large areas of dead leaf tissue. Lesions usually develop first on lower leaves but under favorable weather conditions, extensive leaf blighting over the entire plant may occur.

Northern Corn Leaf Blight (Exserohilum turcicum)

Long, elliptical, grayish-green or tan lesions ranging from 1.0-6.0 inches in length develop on the lower leaves. As the season progresses, nearly all leaves of a susceptible plant may be covered with lesions, giving this plant the appearance of having been injured by frost. During damp weather, dark olive-green to black spores may be produced across surface of lesions.

Laura Sweets
573-884-7307

Pest Update

Hophornbeam Copperleaf

Acalypha ostryifolia **Riddell**

By Kevin Bradley

Hophornbeam copperleaf is a summer annual weed in the Euphorbiaceae, or spurge, family. Hophornbeam copperleaf is also less commonly known as "three-seeded mercury" because the seed pod is divided into three chambers. Hophornbeam copperleaf may grow to as much as 40 inches in height and has distinctly toothed leaves. Hophornbeam copperleaf is primarily a weed of agronomic crops but can also occur along fencerows, in landscapes and in nursery crops.

Hophornbeam copperleaf seedlings have two round cotyledons that are slightly hairy (Figure 1). Hophornbeam copperleaf seedlings are often mistaken for velvetleaf or prickly sida (also called teaweed), but both velvetleaf and prickly sida have seedlings with one round and one heart-shaped cotyledon.

Mature hophornbeam copperleaf plants have leaves that are alternate, egg- or diamond-shaped, with finely toothed margins. Although many members of the spurge family emit a milky sap when broken, hophornbeam copperleaf does not. Mature hophornbeam copperleaf plants are sometimes confused with prickly sida but the leaves of hophornbeam copperleaf are usually much wider than those of prickly sida, and this species does not have small stipules (spines) in the leaf axils like prickly sida (Figure 2).

Hophornbeam copperleaf is monoecious, which means that male and female flowers occur on the same plant. All flowers are relatively inconspicuous. The male flowers occur on axillary spikes while the female flowers are most noticeable and occur on a long, terminal spike (Figure 3). As mentioned previously, hophornbeam copperleaf has seed pods that are divided into three chambers, and these pods split open at maturity. Hophornbeam copperleaf seed are only slighter more than 1 mm in diameter, pear-shaped, and have "dimples" on both surfaces (Figure 4). In research conducted by Horak et al., hophornbeam copperleaf growing alone could produce as many as 12,510 seeds per plant, while plants growing in competition with soybean produced 980 seeds per plant.

Hophornbeam copperleaf emergence can begin in late May to early June and can continue throughout most of the growing season. I believe one of the reasons we have seen an increase in the number of hophornbeam copperleaf infestations in Missouri over the past five years is its ability to germinate late in the season, sometimes well into August. This allows it to escape most herbicide applications completely or often the plants are so small at the time of the postemergence herbicide application that the spray droplets never come in contact with them.

Most of the available research conducted on the management of

Continued on page 89

Figure 1. Hophornbeam copperleaf seedling.

Figure 2. A mature hophornbeam copperleaf plant.

Figure 3. A female hophornbeam copperleaf flower (terminal spike).

Figure 4. Hophornbeam copperleaf seed.

Pest Update: Hophornbeam Copperleaf *continued from page 88*

hophornbeam copperleaf in soybean has revealed that Authority First and other Authority products, FirstRate, and Boundary will provide good preemergence control while glyphosate, Cobra/Phoenix, and Flexstar are effective postemergence products. In corn, atrazine will provide a period of residual control but due to the extended germination potential, season-long control with a preemergence application of atrazine alone is unlikely. Postemergence applications of atrazine and crop oil, 2,4-D, Clarity, Distinct, or Status can also provide good control of hophornbeam copperleaf in corn.

Kevin Bradley
BradleyKe@missouri.edu

Figure 5. Hophornbeam copperleaf infestation late in the season.

Soybean Foliage Diseases May Begin to Show Up *continued from page 86*

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.

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 *2008 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.

Laura Sweets
573-884-7307

Weather Data for the Week Ending July 27, 2008

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.	Jul 1-27-Jul	Departure from long term avg.	Accumulated Since Apr. 1	Departure from long term avg.
Corning	Atchison	87	70	97	67	79	3	2.58	-2.28	1973	92
St. Joseph	Buchanan	86	69	94	67	78	2	3.77	-0.44	1887	-19
Brunswick	Chariton	*	*	*	*	*	*	*	*	*	*
Albany	Gentry	87	69	97	66	77	1	1.08	-3.68	1837	-52
Auxvasse	Audrain	85	67	94	63	75	-2	12.31	9.05	1898	-52
Columbia	Boone	85	68	95	65	76	-2	6.36	2.89	1938	-90
Sanborn Field	Boone	87	69	97	64	77	-1	6.75	3.23	2051	-31
Williamsburg	Callaway	85	67	94	63	75	-2	7.97	3.97	1900	-5
Novelty	Knox	83	66	93	63	74	-2	8.21	4.65	1743	-155
Linneus	Linn	85	67	95	64	75	-1	8.89	4.7	1806	-38
Monroe City	Monroe	83	67	93	64	74	-2	10.4	7.01	1830	-112
Versailles	Morgan	88	70	95	65	78	1	3.32	-0.43	2050	-12
Green Ridge	Pettis	89	70	95	67	79	3	2.18	-1.54	1984	50
Lamar	Barton	94	71	97	69	81	2	4.59	0.62	2104	-41
Cook Station	Crawford	87	67	96	63	76	-2	4.07	0.93	1939	-149
Alley Spring	Shannon	*	*	*	*	*	*	*	*	*	*
Round Spring	Shannon	90	68	99	65	76	-1	2.85	-0.58	1938	-44
Mountain Grove	Wright	88	70	93	66	78	1	1.85	-2.08	1887	-64
Delta	Cape Girardeau	88	68	96	60	77	-2	2.73	-0.15	2186	-156
Cardwell	Dunklin	92	71	99	65	81	0	1.12	-1.61	2489	-56
Clarkton	Dunklin	*	*	*	*	*	*	*	*	*	*
Glennonville	Dunklin	90	71	97	64	80	0	1.66	-1.4	2411	-91
Charleston	Mississippi	89	70	97	62	79	0	1.96	-1.4	2331	15
Portageville-Delta Center	Pemiscot	91	72	98	66	81	1	2.77	0.05	2516	5
Portageville-Lee Farm	Pemiscot	90	72	97	65	81	1	3.04	0.1	2520	28
Steele	Pemiscot	93	72	99	65	82	2	3.06	0.19	2597	82

* Complete data not available for report

‡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.

Pat Guinan
Commercial Agriculture Program
573.882.5908
GuinanP@missouri.edu