Integrated Pest & Crop Management

New Endophytes Coming to Market

By Craig Roberts

Endophytes are organisms that live in plants. In tall fescue, the most important endophyte is *Neotyphodium coenophialum*, a fungus that causes fescue toxicosis. The tall fescue endophyte produces toxins that have a devastating impact on grazing livestock, as these toxins cause poor weight gain, low calving rate, and poor milk reproduction. In terms of "straight dollars," the endophyte toxins cost Missouri beef industry $160 million each year.

In the 1980s, plant breeders removed the toxic endophyte and released "endophyte-free" tall fescue. But the endophyte-free varieties did not persist well. Researchers have since learned that the endophyte in tall fescue helps the plant withstand drought, insects, and pathogens.

In recent years, researchers have taken the endophtye-free plants and inserted them with new strains of the endophyte. These new strains produce little or no toxins, but they greatly increase plant persistence compared to the endophyte-free varieties. The new strains are called "beneficial" because they *help* the plant survive. Occasionally, they are called "novel" because they are *different* than the common endophyte and offer a *unique* use for endophytes. If the new strains produce no toxins, they are called "non-toxic endophytes."

Varieties with Beneifical Endophytes

The first beneficial endophyte to hit the market was MaxQ, which was inserted into Jesup tall fescue. Sometimes this variety is called "**Jesup MaxQ,**" but it is usually simply referred to as "MaxQ." The endophyte was collected and tested by AgResearch, New Zealand. It was inserted into Jesup, an endophyte-free tall fescue developed at the University of Georgia. Jesup MaxQ is being marketed by Pennington Seed Company (Madison, GA).

MaxQ has been tested in grazing trials across the US and has proved to be completely nontoxic to all classes of livestock. In fact it is not only nontoxic, it is also highly nutritional. For the past few years, Jesup MaxQ has been the primary recommendation from MU forage specialists to producers wishing to establish a cool-season perennial pasture of good quality.

A follow-up release from Pennington is **Texoma MaxQII.** This cultivar was developed by the Noble Foundation for the central and south central U.S. It has shown superior growth in states south of Missouri. Tests may prove it can perform well in our state as well.

A new variety, **BarOptima PLUS E34**, was recently released by Barenbrug USA (Tangent, OR). According to their plant breeders, the "E34" endophyte was discovered internally. Barenbrug screened its germplasm bank for endophytes that produced low levels of ergovaline then inserted these endophytes into high quality tall fescue plants; the high quality refers to high digestibility and soft leaf traits of the grass plant. The plant breeding proceeded after the endophyte was inserted. This means that BarOptima PLUS E34 was developed in

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association with the endophyte; the plant breeders did not simply inoculate a preexisting variety.

BarOptima PLUS E34 has been tested in university trials since 2002, although not as many trials yet as Jesup MaxQ. The test code for this variety is 'FA BE9301' or 'BAR FA BE9301A'. BarOptima PLUS E34 has shown excellent persistence in grazing trials. It differs from other varieties with beneficial endophytes in that it produces low levels of endophyte toxins. However, data from grazing trials at Hope, Arkansas show these toxins levels were low enough to not hamper animal performance. Animals grazing BarOptima PLUS E34 performed as well as those grazing Jesup MaxQ.

BarOptima PLUS E34 is currently being sold through various dealers and retailers around the country, including Missouri. It is increasingly being planted by the new large grazing dairies in our state. The cost of seed is just under $100 per acre at the company's recommended seed rate of 25 lb/acre.

A variety soon to be in the market is "**DuraMax Armor,**" with Armor being the name of the endophyte. This variety is being sold by DLF International Seed (Halsey, OR). The plant genetic development occurred at Auburn University with the goal of good performance in the transition zone of the US, a region that includes Missouri. The endophyte strain in this variety, Armor, was collected from Northern Africa and is licensed from the University of Arkansas. The Armor endophyte does not produce an ergovaline alkaloid, so there is no risk of fescue toxicosis. Armor does produce compounds known to deter insects while having no harmful animal impact.

DruaMax Armor has been entered in variety trials under the designation IS FTF-31. Two of the variety trials are being conducted at the University of Kentucky and Cornell University. DuraMax Armor is planned for limited market availability in summer or fall of 2011. Pricing has not been determined at this point, however the intention is to price DuraMax Amor at a level that encourages broader acceptance by cow-calf and stocker operators in the transition zone.

In addition to these cultivars, one is being developed by the **University of Kentucky** and another one to be called **ArkShield**. Be on the lookout for these two new cultivars as they undergo testing and hit the shelves soon.

Planting the New Varieties

Missouri producers who want to plant the new varieties should remember to plan ahead. The old tall fescue is not killed by simply spraying or even spraying and plowing. In our state, new plantings need to follow a recipe known as "spray-smother-spray" with a fall planting in mind (Roberts and Andrae, 2010). This recipe calls for a spray of glyphosate in May, followed by the planting of a smother crop for the summer months, followed by a second glyphosate spray in late August, followed by a no-till planting of the new variety. The reason for the spray-smother-spray method, is that old tall fescue can come back from volunteer seed in the soil or from tillers that escaped the first spray.

Future research may show that a new establishment procedure will work in Missouri. Researchers in Georgia and South Carolina have tested a "mow-mow-spray-spray" recipe (Roberts and Andrae, 2010). It calls for two mowings in the spring to prevent seed from developing, followed by a spray 6 weeks prior to planting and a second spray immediately prior to planting. This recipe allows the new variety to be drilled directly into the old stubble, and it has proven effective in all cases tested in the southern US.

Producers wanting to try these new varieties should contact their local extension specialist, as well as representatives from the companies listed above.

Literature Cited

Roberts, C., and J. Andrae. 2010. Fescue toxicosis and management. ASA and CSSA, Madison, WI.

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Soybean Foliage Diseases May Begin to Show Up

By Laura Sweets

Again, the 2011 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. Since a significant number of acres were late planted, soybean foliage diseases have not been particularly widespread or severe so far this season. I have seen low levels of Septoria brown spot on the first true leaf of very early planted soybean plants. 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. 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 *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 found 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

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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.

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.

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Weed of the Month: Hophornbeam Copperleaf

By Kristin Rosenbaum and Kevin Bradley

Hophornbeam copperleaf (Acalypha ostryifolia Riddell), also known as three-seeded mercury, is a summer annual that may grow to as much as 40-inches in height with distinctly toothed leaves. Hophornbeam copperleaf is primarily a weed of agronomic crops, but can also occur along fencerows, pastures, wastelands, roadsides, and landscapes or nursery crops. Hophornbeam copperleaf is a herbaceous dicot plant in the Euphorbiaceae, or spurge, family but lacks the milky sap that is characteristic of most members of this family.

Figure 1. A hophornbeam copperleaf seedling. Notice the two round cotyledons which help to distinguish it from other similar species like prickly sida.

Hophornbeam copperleaf seedlings have two round cotyledons that are slightly hairy (Figure 1). Seedlings are often mistaken for prickly sida (or teaweed), but prickly sida has one round and one heart-shaped cotyledon. The leaf margins of prickly sida are more coarsely serrated than those of hophornbeam copperleaf, and hophornbeam copperleaf does not have the small stipules (spines) in the leaf axils like prickly sida. Hophornbeam copperleaf emergence can typically occur anywhere from late-May through the rest of the summer months until the first frost.

Mature hophornbeam copperleaf plants have leaves that are arranged alternately along the stem, are egg- or diamond-shaped, and have finely toothed margins (Figure 2). Hophornbeam is monoecious, which means both male and female flowers occur on the same plant. Flowers are inconspicuous but male flowers are found on axillary spikes while female flowers are observed on a long terminal spike. This weed is also known as three-seeded mercury because the seed pod is divided into three chambers which split open at maturity. Seed pods contain many seeds, with some studies reporting as many as 12,518 seeds produced per plant when grown alone and 980 seeds per plant when grown in competition with soybeans.

Hophornbeam copperleaf seems to be an increasing weed problem in Missouri, especially in soybean production fields throughout the state. Since this weed is capable of germinating throughout the summer, we often see infestations of this weed develop after post-emergence applications of non-residual herbicides like glyphosate have been made. On the other hand, even if this weed is emerged at the time of the post-emergence herbicide application, it may be so low in the canopy at the time of application that we fail to get adequate herbicide coverage on the leaf surfaces. For these reasons, an effective management program must consider the late-emerging tendency of this species.

Figure 2. A mature hophornbeam copperleaf plant.

Residual, soil-applied herbicides that include sulfentrazone (in Authority products), cloransulam (FirstRate, in AuthorityFirst, in Sonic), flumioxazin (in Valor products, in Envive) or metribuzin (Sencor, in Boundary, in Authority MTZ, etc.) have been shown to provide good to excellent control of hophornbeam copperleaf in soybeans. Post-emergence herbicides that should provide good control of emerged plants include fomesafen (Flexstar, Dawn, etc.), lactofen (Cobra, Phoenix), acifluorfen (Ultra Blazer), glyphosate (Roundup, etc.) or glufosinate (Ignite for use only in LibertyLink soybeans).

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Corn Foliage Diseases

By Laura Sweets

This is shaping up to be another "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 although not as far behind normal as it was at this time last year. There is also a wide range in growth stages of corn 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.

So far the samples that have been submitted have had anthracnose leaf blight on the lowest leaves, especially in fields with corn on corn (see May 24 issue of the *Integrated Pest & Crop Management Newsletter* for more detailed information on anthracnose of corn). However, corn growth over the last week to 10 days has been incredible. Plants that were at the 2-3 leaf stage around June 5 are now 3-4 feet tall. The anthracnose lesions which were so evident on the first true leaf and the oldest, smallest leaves on plants in early June are in some cases now hard to find. The small leaves at the very base of the plant have sloughed off or are sloughing off and lesions are not very prevalent on the leaves that have emerged with the rapid growth over the last week to 10 days.

Gray leaf spot, common rust and southern rust are the foliage diseases most likely to occur on corn in Missouri over the next few weeks. 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. I have had some questions abo ut the bacterial leaf spot, Holcus leaf spot. Although this disease would be likely to occur after hail storms or rain storms with hard, driving winds, I have not seen any samples that were positive for Holcus leaf spot yet this year.

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 *2011 Missouri Pest Management Guide: Corn, Grain Sorghum, Soybean and Winter Wheat M171* for fungicides labeled for use on field corn.

In making the decision on whether or not to apply a foliar fungicide to corn it is important to consider the yield potential of each individual field. If fields are uneven and struggling because of wet conditions, foliar fungicides are less likely to give significant increases in yield. If nitrogen loss is a problem again because of wet conditions, it may be more beneficial to correct the nitrogen deficiency than apply a fungicide. Foliar fungicides may give greater yield increases on susceptible hybrids than on hybrids with resistance to the foliage disease present. With foliar fungicides it is important to be scouting fields so that products are applied before the disease has built up to high levels. Later planted fields which will have plants at earlier growth stages later in the season may also benefit more from fungicide application if diseases are occurring than early planted fields which are at more advanced growth stages.

With the wide range in planting dates and plant vigor across the state it is impossible to make blanket assessments of the incidence or severity of corn foliage diseases or to make statewide management recommendations. Individual fields need to be monitored for stand, vigor and yield potential, for other issues such as nitrogen loss or weed escape problems, for the foliage diseases present and the severity of those diseases as well as for the forecast weather conditions in the area before deciding to apply a foliar fungicide.

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

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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.

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Weather Data for the Week Ending July 5, 2011

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 1-30	Departure from long term avg.	Accumulated Since Apr. 1	Departure from long term avg.
Corning	Atchison	89	71	95	66	80	+4	5.68	+1.17	1513	+200
St. Joseph	Buchanan	88	70	95	63	79	+4	4.93	+0.03	1454	+140
Brunswick	Carroll	87	71	94	65	79	+4	4.40	-0.66	1502	+149
Albany	Gentry	89	68	95	59	79	+4	2.97	-1.87	1412	+130
Auxvasse	Audrain	90	69	95	62	79	+4	4.18	-0.70	1514	+152
Vandalia	Audrain	90	68	94	60	79	+4	4.19	-0.31	1461	+140
Columbia-Bradford Research and Extension Center	Boone	91	68	98	62	79	+3	3.04	-1.44	1499	+91
Columbia-Capen Park	Boone	93	67	97	59	79	+3	2.90	-1.88	1518	+57
Columbia-Jefferson Farm and Gardens	Boone	91	69	97	64	80	+4	2.46	-2.05	1539	+129
Columbia-Sanborn Field	Boone	91	71	95	65	81	+5	3.23	-1.55	1638	+177
Columbia-South Farms	Boone	90	70	95	65	79	+3	2.83	-1.71	1534	+126
Williamsburg	Callaway	91	68	96	61	79	+4	4.32	-0.15	1530	+211
Novelty	Knox	88	68	93	58	78	+3	7.54	+3.44	1333	+24
Linneus	Linn	87	68	94	58	78	+4	4.62	-0.49	1385	+114
Monroe City	Monroe	89	68	93	59	78	+3	2.84	-0.97	1419	+70
Versailles	Morgan	93	71	99	66	81	+5	3.55	-0.88	1673	+218
Green Ridge	Pettis	92	70	98	66	81	+5	2.69	-2.76	1565	+182
Lamar	Barton	96	71	99	68	83	+6	2.60	-3.63	1730	+217
Cook Station	Crawford	91	67	96	61	78	+2	3.13	-1.24	1625	+154
Round Spring	Shannon	93	67	98	64	78	+3	2.31	-1.58	1576	+176
Mountain Grove	Wright	92	69	96	66	79	+4	1.68	-2.11	1577	+226
Delta	Cape Girardeau	91	68	98	63	79	+1	5.13	+1.72	1820	+126
Cardwell	Dunklin	92	70	98	68	81	+1	3.78	+0.19	2059	+179
Clarkton	Dunklin	93	69	99	65	81	+1	0.85	-2.74	1998	+158
Glennonville	Dunklin	93	70	98	69	81	+2	2.07	-1.13	1988	+157
Charleston	Mississippi	91	68	96	65	79	+1	3.41	-0.64	1891	+196
Portageville-Delta Center	Pemiscot	92	71	98	68	81	+1	2.06	-1.89	2070	+210
Portageville-Lee Farm	Pemiscot	91	70	97	66	81	+1	2.36	-1.41	2058	+214
Steele	Pemiscot	93	72	99	70	82	+2	3.97	-0.11	2133	+262

‡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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Insect Pest & Crop Management newsletter is published by the MU IPM Program of the Division of Plant Sciences Extension. Current and back issues are available on the Web at **http://ppp.missouri.edu/newsletters/ipcmindex.htm**. Mention of any trademark, proprietary product or vendor is not intended as an endorsement by University of Missouri Extension; other products or vendors may also be suitable.

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