Integrated Pest & Crop Management

Make Sure You Burndown Cover Crops Effectively

By Kevin Bradley

For those growers who may have planted cover crops last fall, it will be very important to apply an effective burndown to these species in the coming weeks. Cover crops that aren't effectively controlled prior to planting this spring can become a weed that takes moisture and nutrients away from the developing corn or soybean plants. Tables 1-3 show some of our recent research results related to the effects of some common herbicide burndown programs on the control of different cover crop species.

Tables 1 and 2 show the response of wheat, cereal rye, annual ryegrass, crimson clover, hairy vetch, and winter pea to a variety of herbicide burndown treatments. Table 1 shows the control provided by these treatments when applied earlier in the spring on April 5th, while Table 2 shows the control provided by these same treatments applied later in the spring, on May 1st. As you can see from the results presented in both tables, it is very important to make a timely and effective burndown herbicide application, regardless of which cover crop species you have present. Also, it seems clear from our results that the effectiveness of these different herbicide treatments will vary by cover crop species, but overall some of the species that have proven the most difficult to control in our research are annual ryegrass, wheat, and crimson clover. On the other hand, some of the cover crop species that these burndown treatments have controlled fairly well include cereal rye, hairy vetch, and winter pea. It is also important to note that tillage radish and oats winter-killed in our experiments, although they were a part of the study initially. In our experiences so far in central Missouri, neither of these species will over-winter.

Due to the troublesome and persistent nature of annual ryegrass, we also conducted a separate experiment to evaluate more treatments and timings for the control of this species. The results from this experiment are shown in Table 3. Once again, one of the most important take-home messages from this experiment is that the timing of the burndown herbicide application is critical to the level of annual ryegrass control achieved. For example, in this experiment the average level of annual ryegrass biomass reduction with the glyphosate-containing treatments evaluated was 91% when applications were

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Mizzou Weed Science Now on Facebook, Twitter, and YouTube

Kevin Bradley, Mandy Bish, and Alex Long

We've decided to enter into the social media age and will now be sending more of our weed science research results and recommendations out to you through Facebook, Twitter, and YouTube. You can now follow Mizzou Weed Science on twitter @ShowMeWeeds and on Facebook (https://www.facebook.com/weedscience.missouri). For video summaries of recent weed-related topics and research results, subscribe to our YouTube channel "Mizzou Weed Science" (https://www.youtube.com/channel/UCh59GTxMGBJ9jRrMw2rjagw) or visit our website for more information (http://weedscience.missouri.edu). We hope these resources will prove to be valuable to you in the future!

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made to 5 ¾-inch annual ryegrass, but declined to 77 and 58% when these same herbicide treatments were applied to 14- and 36-inch annual ryegrass, respectively.

There are two other things to keep in mind when it comes to the results of this study. First, our base rate of Roundup PowerMax that we used in all of these treatments was 36 ounces per acre. Based on the results from last year's study it seems clear that this rate may need to be even higher for ryegrass. Second, we weren't able to include tank-mixes mixes of glyphosate plus certain grass herbicides like clethodim (SelectMax, Arrow, etc.) in the trial last year but there is some data coming out of the southern United States that shows these mixes are effective. For example, several weed science colleagues in the southern states where ryegrass problems are more severe have seen good results with glyphosate plus Select Max at 10 to 16 ounces per acre.

Because ryegrass can be especially difficult to control in the spring, consider the following tips to achieve a more effective burndown of this species: 1) make sure to adjust spray settings (higher GPA, nozzle selection, etc.) to optimize spray coverage, 2) spray during daylight hours when annual ryegrass is actively growing, preferably at temperatures around 60 F, 3) spray at least 4 hours prior to sunset to allow for maximum herbicide translocation, and 4) try to avoid spraying when day or night time temperatures are forecasted in the 30's for an extended period of time.

Table 1. Influence of early spring (April 5th) herbicide treatments on the control of various cover crop species (Columbia, Missouri 2013)

Herbicide Treatment	Rate	Wheat	Cereal Rye Rye	Annual Ryegrass	Crimson Clover	Hairy Vtech	Cereal Rye Vtech	Winter Pea	*Avg. Control
	product/A	% Control 21 Days After Treatment							
Roundup PowerMax	28 fl ozs	83	98	93	22	20	100	72	70
Roundup PowerMax + 2,4-D	28 fl ozs + 1 pt	65	95	93	33	100	98	78	80
Roundup PowerMax + Clarity	28 fl ozs + 16 fl oz	62	95	88	28	98	98	97	81
Roundup PowerMax + Sharpen	28 fl ozs + 1 fl oz	78	97	92	87	15	95	80	78
Roundup PowerMax + Aatrex	28 fl ozs + 1 qt	32	68	78	38	18	78	70	55
Roundup PowerMax + Canopy	28 fl ozs + 4 ozs	37	63	73	35	15	65	45	48
Gramoxone Inteon	4 pts	30	57	28	22	20	58	33	35
Gramoxone Inteon + 2,4-D	4 pts + 1 pt	32	57	32	30	95	65	83	56
Gramoxone + Aatrex	4 pts + 1 qt	40	70	78	80	18	75	38	57
	LSD0.05:	---------- 15 ----------							

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Table 2. Influence of late spring (May 1st) herbicide treatments on the control of various cover crop species (Columbia, Missouri 2013)

Herbicide Treatment	Rate	Wheat	Cereal Rye Rye	Annual Ryegrass	Crimson Clover	Hairy Vtech	Cereal Rye Vtech	Winter Pea	*Avg. Control
	product/A	% Control 21 Days After Treatment							
Roundup PowerMax	28 fl ozs	37	93	65	57	97	90	85	75
Roundup PowerMax + 2,4-D	28 fl ozs + 1 pt	30	92	77	58	100	93	85	76
Roundup PowerMax + Clarity	28 fl ozs + 16 fl oz	32	82	67	43	97	82	90	70
Roundup PowerMax + Sharpen	28 fl ozs + 1 fl oz	27	90	75	90	100	78	100	80
Roundup PowerMax + Aatrex	28 fl ozs + 1 qt	30	33	32	32	98	30	87	49
Roundup PowerMax + Canopy	28 fl ozs + 4 ozs	18	30	22	28	92	23	83	42
Gramoxone Inteon	4 pts	92	97	95	100	100	100	98	97
Gramoxone Inteon + 2,4-D	4 pts + 1 pt	92	100	95	95	100	98	100	97
Gramoxone + Aatrex	4 pts + 1 qt	95	100	95	82	99	100	100	96
	LSD0.05:	---------- 11 ----------							

Table 3. Influence of herbicide treatments and application timings on the control of an annual ryegrass cover crop (Columbia, Missouri 2013).

		Application Timing and Ryegrass Stage		
Herbicide Treatment	Rate	Early (April 2) 5.75"; Tillering	Mid (April 22) 14"; PreBoot	Late(May 16) 36"; Boot
	product/A	% Biomass Reduction 28 Days After Treatment		
Roundup PowerMax	36 fl ozs	93	80	63
Roundup PowerMax + 2,4-D	36 fl ozs + 1 pt	92	75	57
Roundup PowerMax + Clarity	36 fl ozs + 1 pt	87	65	64
Roundup PowerMax + Sharpen	36 fl ozs + 1 fl oz	90	76	54
Roundup PowerMax + Aatrex	36 fl ozs + 1 qt	91	81	55
Roundup PowerMax + Canopy	36 fl ozs + 4 ozs	88	79	47
Roundup PowerMax + Basis Blend	36 fl ozs + 1.25 ozs	83	78	56
Roundup PowerMax	72 fl ozs	90	78	65
Gramoxone Inteon	4 pts	78	77	44
Gramoxone Inteon + 2,4-D	4 pts + 1 pt	90	77	52
Gramoxone Inteon + Aatrex	4 pts + 1 qt	87	82	54
Gromoxone Inteon + Lorox	4 pts + 24 ozs	89	83	50
Gramoxone Inteon + Sencor + 2,4-D	4 pts + 4 ozs + 1 pt	90	87	60
Liberty	29 fl ozs	35	50	34
Liberty + Atrazine	29 fl ozs + 1 qt	71	50	45
LSD0.05 (treatments x timings):		---------- 15 ----------		

Check Wheat Fields for Early Season Diseases

By Laura Sweets

The wheat acreage in the state has been estimated at close to one million acres for 2014. Although wheat planting was slightly ahead of normal last fall, the condition of the crop as rated by the Missouri Agricultural Statistic Service was 2 percent poor, 48 percent fair, 47 percent good and 3 percent excellent as of November 24, 2013. Much of the state has had an unusually cold winter with minimal continuous snow cover. Soil temperatures have been cold to greater than normal depths. March has also been colder than normal. Wheat green up is slow this year. When temperatures finally do warm up and wheat begins to green, it may be possible to access stands for winter survival, uniformity and the presence of wheat diseases such as virus diseases, Septoria leaf blotch and powdery mildew.

Septoria leaf blotch can develop on small seedlings in the fall and scattered lesions can be found in the spring. Lesions of Septoria leaf blotch begin as light yellow flecks or streaks. These flecks expand into yellow to reddish-brown, irregularly shaped blotches. As the lesions mature, the centers may turn lighter gray in color and dark brown specks (fruiting bodies or pycnidia of the causal fungus) may be scattered within the centers of the mature lesions. With the dry conditions and low relative humidity most of the state is experiencing, Septoria leaf blotch incidence might be quite low this spring.

Last spring there were numerous calls from the southwestern region of the state about powdery mildew. Powdery mildew infections begin as light-green to yellow flecks on the leaf surface. As powdery mildew develops the leaf surfaces become covered with patches of cottony white mold growth of Erysiphe graminis f. sp. tritici, the causal fungus. These patches eventually turn a grayish-white to grayish-brown in color and small black fungal fruiting bodies may be visible within the patches of mildew growth.

Powdery mildew is not usually a problem on soft red winter wheat in Missouri. Disease development is favored by moderate temperatures in the range of 59-72 F and prolonged periods of cloudy weather. Powdery mildew is also favored by high nitrogen levels, lush growth and dense canopies. It is more severe on susceptible varieties and when plants are lodged. In talking with individuals who saw powdery mildew in southwest Missouri wheat fields last spring, it appeared that the higher incidence of powdery mildew could have been related to wheat planted after harvesting low-yielding corn and/or to higher than usual seeding rates. In the first situation there might have

been residual nitrogen left over from the low-yielding corn that the wheat utilized. If normal nitrogen rates were applied in addition to residual nitrogen in the field this could have favored powdery mildew development. Then, because of the extremely dry conditions the previous fall, seeding rates may have been increased in an attempt to guarantee a stand. If the stand was dense or if plants were in clumps, powdery mildew might have been present. These conditions aren't an issue this season and with limited wheat growth, possibly poor tillering and dry conditions, powdery mildew isn't expected to be an early season problem this year.

Green-up is the time of the year when symptoms of wheat spindle streak mosaic, wheat soilborne mosaic and barley yellow dwarf may become evident in winter wheat fields. Both wheat spindle streak mosaic and wheat soilborne mosaic tend to be more severe when wet conditions occur after planting in the fall or in the late winter/early spring months. Cool spring temperatures also enhance symptom development of both wheat spindle streak mosaic and wheat soilborne mosaic. Most of the state was dry and, in spite of several significant snowfalls, soil moisture levels are still low. So it will be interesting to see how prevalent and severe wheat spindle streak and wheat soilborne are this season. Although there are no rescue treatments for wheat virus diseases, it is still a good idea to scout fields for plants showing virus symptoms and to send in samples to identify the virus or combination of viruses that are present so that proper preventative management measures can be used the next time wheat is planted in that field.

Descriptions of the wheat virus diseases most likely to occur on winter wheat in Missouri are given in the following paragraphs.

Symptoms of wheat spindle streak mosaic appear in early spring as yellow-green streaks or dashes on the dark green background of the leaves. These lesions usually run parallel to the leaf veins and tend to be tapered at the ends giving the lesions a spindle shaped appearance. Foliage symptoms are most obvious when air temperatures are about 50°F. As temperatures warm-up, foliage symptoms of wheat spindle streak mosaic tend to fade. Plants may be slightly stunted and have fewer tillers than normal. Wheat spindle streak mosaic tends to be more prevalent in lower, wetter areas of a field. The virus which causes this disease is soilborne and is spread by the soil fungus Polymyxa graminis. Wet falls tend to favor outbreaks of wheat spindle streak mosaic the following spring.

Wheat soilborne mosaic causes light green to yellow green to bright yellow mosaic patterns in leaf tissues. Symptoms are most evident on early spring growth, and warmer temperatures later in the season slow disease development. Symptoms of wheat soilborne mosaic are not always particularly distinctive and might occur as a more general yellowing similar to that caused by nitrogen deficiency. Infected plants may be stunted. This disease may be more severe in low lying, wet areas of a field. The soilborne wheat mosaic virus survives in the soil and is spread by the soil fungus Polymyxa graminis. Again, wet falls tend to favor outbreaks of wheat soilborne mosaic the following spring.

Barley yellow dwarf is an extremely widespread virus disease of cereals. Symptoms include leaf discoloration ranging from a light green or yellowing of leaf tissue to a red or purple discoloration of leaf tissue. Discoloration tends to be from the leaf tip down and the leaf margin in towards the center of the leaf. Plants may be stunted or may have a rigid, upright growth form. Symptoms are most pronounced when temperatures are in the range of 50-65°F. The barley yellow dwarf virus persists in small grains, corn and perennial and annual weed grasses. More than twenty species of aphids can transmit the barley yellow dwarf virus. Symptoms may be more severe and yield losses higher if plants are infected in the fall or early in the spring. Infections developing in late spring or summer may cause discoloration of upper leaves but little stunting of plants or yield loss.

The other virus disease likely to occur on winter wheat in Missouri is wheat streak mosaic, but symptoms of this disease are not usually evident until later in the season when air temperatures increase. Wheat streak mosaic causes a light green to yellow green mottling and streaking of leaves. Symptoms may vary with variety, virus strain, stage of wheat growth when plants are infected and environmental conditions. Plants may be stunted. As temperatures increase later in the spring, yellowing of leaf tissue and stunting of plants may become more obvious. The wheat streak mosaic virus is spread by the wheat curl mite. Symptoms are frequently found along the edges of fields where the mite vector first entered the field. Both the wheat streak mosaic virus and the wheat curl mite survive in susceptible crop and weed hosts. Thus, the destruction of volunteer wheat and weed control are important management options for wheat streak mosaic.

A management program for virus diseases of wheat should include the following steps.

- Plant good quality seed of resistant varieties.
- Avoid planting too early in the fall to minimize opportunity for insect vectors to transmit viruses to young plants.
- Destroy volunteer wheat and control weed grasses.
- Maintain good plant vigor with adequate fertility.

Two-pass Corn Herbicide Programs are Almost Always the Best

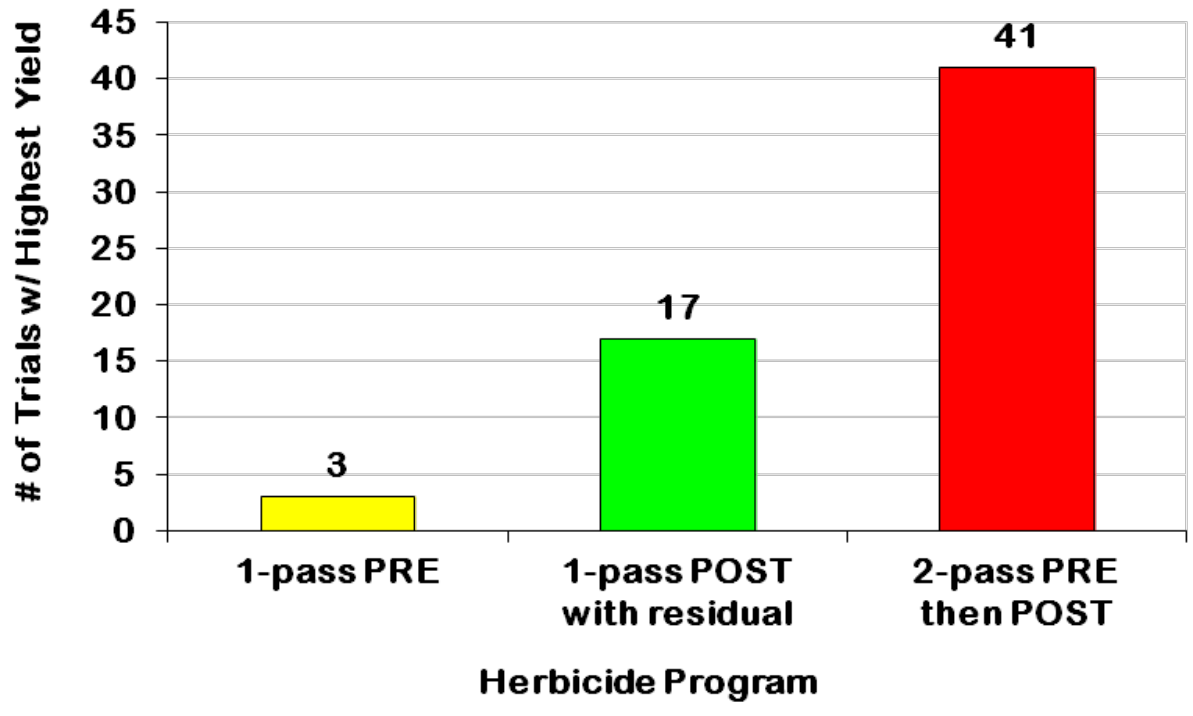
By Kevin Bradley

Regardless of whether you intend to plant a Roundup Ready, Liberty Link, or conventional corn variety this year, it is important to think about the type of weed management program you will utilize. Since we have evaluated a lot of different herbicide programs over the years, I decided to "mine" our database of research results (www.weedscience.missouri.edu/weedtrials/index.cfm) in order to understand which program approach is most likely to provide highest corn yields. Understand that the objective of this "data mining" exercise was not to compare any one specific herbicide treatment to another, but rather to compare the different type of herbicide program approaches one might utilize for weed management in corn.

I was able to make a fair comparison of three different program approaches that have been evaluated in 61 trials in Missouri over the past 11 years. What I found was that in 41 of 61, or 67% of the trials, highest corn yields were obtained with a two-pass program that consisted of a pre-emergence herbicide followed by a post-emergence herbicide. A one-pass post-emergence program that also contained a residual herbicide provided highest corn yields in 28% of the trials, whereas in 5% of the trials a one-pass pre-emergence herbicide program provided highest corn yields.

Collectively, what all of this indicates to me is that depending on the year, environment, soil type, and weed spectrum, either of these program approaches might work, but year in and year out, the two-pass herbicide program is most likely to provide the highest levels of weed control and corn yield. I want to emphasize that the response to these different programs is likely to vary from one location to another, and will be highly dependent on the weed spectrum that you have in your fields. So, if you have been using a one-pass pre-emergence herbicide program for years and have no complaints, chances are you probably have a pretty low weed density in your fields, and/or you do not have very many weed species that germinate later in the season. However, with the typical spectrum of weeds that we have in Missouri (i.e., cocklebur, waterhemp, ragweeds, sunflower, foxtails, fall panicum, etc.), our data show that a post-emergence application is usually required for weeds that have escaped or germinated since the initial pre-emergence herbicide application.

Herbicide Programs that Provided Highest Corn Yields in MU Weed Science Research Trials from 2002-2013 (n=61 trials, 720 treatment observations)



The Plant Diagnostic Clinic Reopens on April 1, 2014

By Patricia Wallace

The University of Missouri Plant Diagnostic Clinic was established in 1965 to provide answers to plant health questions. The clinic receives samples from various agencies, businesses and private citizens throughout Missouri.

The mission of the clinic is to provide accurate, timely answers and management recommendations for plant diseases. Management recommendations reflect research-based results and an integrated pest management (IPM) philosophy. Besides addressing plant diseases the clinic handles samples submitted for identification of weeds, mushrooms, insects or arachnids.

We welcome your sample submissions to the clinic. In addition to serving you, the samples you send help to determine what plant health issues are occurring around the state. All diagnostic results are maintained in the National Plant Diagnostic Network's National Repository. This system helps to track disease occurrence and spread, quarantined or threatening pest locations and noxious weeds.

Patricia Wallace is now serving as the clinic Director and along with clinic staff will handle your samples. When necessary, the clinic can utilize the expertise of University of Missouri State Extension Specialists and faculty in the Division of Plant Sciences who specialize in Agronomy, Entomology, Horticulture or Plant Pathology to ensure accurate and effective diagnosis and reporting.

Please visit the Plant Diagnostic Clinic website for:

- Information on how to collect and ship a sample
- Submission forms (types of samples accepted)
- Plant Disease Identification
- Turfgrass Disease Identification
- Insect/Arachnid Identification
- Plant/Weed Identification (to include mushrooms)
- Clinic hours for dropping off a sample
- Fees associated with services

Contact information:

University of Missouri—Plant Diagnostic Clinic
28 Mumford Hall
Columbia, MO 65201
Phone: 573-882-3019
Email: plantclinic@missouri.edu
Web: http://plantclinic.missouri.edu

Weather Data for the Week Ending March 30, 2014

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.	March 1-30	Departure from long term avg.	Accumulated Since Apr.1	Departure from long term avg.
Corning	Atchison	58	29	77	19	42	-4	0.15	-1.90	*	*
St. Joseph	Buchanan	54	31	73	24	41	-5	0.64	-1.44	*	*
Brunswick	Carroll	53	29	73	20	41	-7	1.09	-1.21	*	*
Albany	Gentry	54	28	74	18	40	-6	0.70	-1.49	*	*
Auxvasse	Audrain	52	29	71	20	41	-6	1.57	-1.15	*	*
Vandalia	Audrain	51	28	69	20	39	-7	1.44	-1.40	*	*
Columbia-Bradford Research and Extension Center	Boone	53	28	71	17	40	-8	0.94	-2.04	*	*
Columbia-Capen Park	Boone	55	28	74	17	42	-7	1.52	-1.35	*	*
Columbia-Jefferson Farm and Gardens	Boone	53	30	71	20	41	-7	0.99	-1.98	*	*
Columbia-Sanborn Field	Boone	53	32	72	23	42	-7	1.82	-1.11	*	*
Columbia-South Farms	Boone	53	30	70	19	41	-7	1.02	-2.00	*	*
Williamsburg	Callaway	52	29	70	17	40	-7	0.89	-2.07	*	*
Novelty	Knox	50	28	68	19	39	-8	0.66	-1.76	*	*
Linneus	Linn	52	29	71	20	40	-6	0.77	-1.54	*	*
Monroe City	Monroe	51	28	68	18	39	-8	1.18	-1.34	*	*
Versailles	Morgan	55	30	73	24	43	-6	0.99	-1.98	*	*
Green Ridge	Pettis	54	29	72	22	42	-6	1.00	-1.71	*	*
Lamar	Barton	57	30	71	24	44	-6	1.33	-2.16	*	*
Cook Station	Crawford	54	26	68	16	41	-9	2.05	-1.65	*	*
Round Spring	Shannon	57	27	68	16	43	-6	2.66	-1.03	*	*
Mountain Grove	Wright	53	30	65	21	41	-7	1.77	-2.02	*	*
Delta	Cape Girardeau	52	32	62	23	42	-9	2.23	-2.02	*	*
Cardwell	Dunklin	57	36	66	26	47	-7	3.70	-0.45	*	*
Clarkton	Dunklin	55	34	66	24	45	-7	2.81	-0.94	*	*
Glennonville	Dunklin	54	34	64	26	45	-7	2.71	-0.96	*	*
Charleston	Mississippi	54	34	66	23	44	-8	2.89	-0.82	*	*
Portageville-Delta Center	Pemiscot	55	35	67	27	46	-7	3.80	-0.05	*	*
Portageville-Lee Farm	Pemiscot	56	36	67	24	46	-7	3.23	-0.60	*	*
Steele	Pemiscot	57	36	68	27	47	-6	3.26	-0.86	*	*

‡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.

Weather Data provided by Pat Guinan
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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://ipm.missouri.edu/ipcm/**. 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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