Plant Protection Programs University of Missouri

Integrated Pest & Crop Management

Resistance Run Amok

By Kevin Bradley

Last year we conducted a survey, primarily of the northern half of Missouri, in which we looked for weedy soybean fields just before the time of soybean harvest. As we came across these fields we collected some of the surviving weed seedheads, recorded GPS coordinates and other information about the field, then gleaned the seed for subsequent herbicide resistance testing in the greenhouse. Some chemical industry representatives, agricultural retailers, extension agronomists, and crop consultants also sent in for seed for testing. This survey was targeted primarily towards waterhemp, but we did harvest and test several other species as well. In the end, we ended up with 88 waterhemp and 9 palmer pigweed populations to test. This process has taken an incredibly long amount of time to complete and is still ongoing with some of the other species not shown in Figure 1, but we have recently completed our analysis of the waterhemp and palmer pigweed populations.

In this screening, I classified a population as "resistant" if 60% or more of the plants sprayed with a 2X rate of glyphosate (1.5 lbs a.e.) were alive and clearly capable of reproduction three weeks after treatment. In most cases, we sprayed at least 30 plants from each population for this determination. Based on this classification, we identified 45 separate waterhemp populations across 28 counties in Missouri that were resistant to glyphosate (Figure 2). This represents 51% of the total waterhemp populations collected. Although there weren't many samples taken from the boot heel region, we also identified both glyphosate-resistant waterhemp and glyphosate-resistant palmer amaranth populations from Scott and Mississippi counties, respectively (Figure 2). The good news, if there could be any good news in all of this, is that we also screened for resistance to the PPO-inhibiting herbicides in these same populations and found very few instances of PPO resistance. In fact, we only identified 1 population of the 88 waterhemp populations sampled that was clearly resistant to the PPO-inhibiting herbicides.

As this survey was mostly completely random in nature (i.e., simply looking for weedy soybean fields and harvesting seed), these results are both surprising and concerning to me. It seems clear that we now have quite a significant amount of our acreage with infestations of glyphosate-resistant waterhemp. As part of our ongoing effort to try to determine the extent of this problem in Missouri, we will be continuing this survey in 2009 and will focus our efforts on the southeastern and southwestern edges of the state.

So, if you have or suspect you have a glyphosate-resistant pigweed species like waterhemp or palmer pigweed present what can you do about it? First, if you decide to stay with soybeans you must rotate to an alternative herbicide that is effective on your resistant weed species and acts at a site-of-action different from glyphosate. In soybeans, this usually means you will need to use a preemergence herbicide. In our research, we have observed that preemergence soybean herbicide treatments like AuthorityFirst and the other Authority-based products, Sonic, Prefix, Boundary, Dual II Magnum, and Valor will all provide excellent control of glyphosate-resistant waterhemp, although a postemergence follow-up treatment will still usually be required due to the nature of waterhemp germination. In addition to these preemergence herbicide options, the postemergence PPO-inhibiting herbicides like Phoenix, Cobra, Ultra Blazer, Flexstar, etc. should also provide good control of glyphosate-resistant waterhemp

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Webworm Problems In Double-Crop Soybean

By Wayne Bailey

During the past two weeks, many fields of double-crop and late planted soybean have experienced problems with webworms. These fields have covered a relatively large area including western and southwest Missouri. It is unknown which webworm species reached the economic threshold in these fields, although several webworms do attack soybean plants. Webworms eggs are laid on seedling soybean plants by small moths. These eggs quickly hatch with larvae moving to plant terminals to wrap plant tissues in pockets of webbing in which the developing larvae feed on foliage. The economic threshold for webworms in soybean is to treat when 10 to 12% or more of plants have heavy webbing on plant terminals and defoliation has reached 30% prebloom and 20% from bloom to pod fill. Webworms rapidly move through their life cycle with numerous small dull colored moths often seen in fields following completion of larval development. These moths generally move to other fields or hosts to lay eggs for the next generation.

Table 1. Webworms

Webworms			
Comments: Treat when 10% to 12% of plants show heavy webbing on top leaflets or when defoliation reaches 30% before bloom or 20% from bloom to pod fill.			
Common Name	***Trade Name***	***Rate of formulated material per acre***	***Placement***
permethrin	***Ambush 25W**	6.4 to 12.8 fl. oz.	On foliage
cyfluthrin	***Baythroid XL**	1.6 to 2.8 fl. oz.	On foliage
bifenthrin	***Brigade 2 EC**	2.1 to 6.4 fl. oz.	On foliage
chlorpyrifos + gamma-cyhalothrin	***Cobalt**	13 to 26 fl. oz.	On foliage
zeta-cypermethrin +	***Hero**	4.0 to 10.3 fl. oz.	On foliage
zeta-cypermethrin	***Mustang Max**	2.8 to 4.0 fl. oz.	On foliage
permethrin	***Pounce 3.2EC**	4.0 to 8.0 fl. oz.	On foliage
gamma-cyhalothrin	***Proaxis**	3.2 to 3.84 fl. oz.	On foliage
carbaryl	**Sevin XLR Plus**	2 to 3 pt.	On foliage
lambda-cyhalothrin	***Warrior**	3.2 to 3.84 fl. oz.	On foliage

***Designates a restricted-use pesticide. Use is restricted to certified applicators only.** Regardless of the formulation selected, read the label to determine appropriated insecticide rates, directions, precautions, and restrictions.

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Soybean Aphids Found in North Missouri

By Wayne Bailey

Low numbers of soybean aphids (*Aphis glycines* Matsamura) can be found in some north Missouri soybean fields. Numbers remain very low in many fields with an average of 1 to 5 aphids or less on up to 50% of the soybean plants. A much lower number of fields have higher numbers of aphids averaging in the range of 60 to 100 aphids per plant. In most fields, beneficial insects such as 12-spotted, Asian, and pink ladybird beetles, insidious flour bugs, and damsel bugs populations are actively feeding on the soybean aphids. Beneficial insects can have major detrimental impact on soybean aphids with low to moderate aphid populations often quickly eliminated from infested fields. Warm weather predicted for the first couple weeks of August also should help slow aphid reproduction. Soybean aphid reproduction is most rapid when temperatures of 72-77 degrees F and relative humidity below 78% occur during late July and early August. A limited number of fields have received insecticide applications for this pest at this time in the growing season.

Populations of winged soybean aphid most likely migrated into Missouri from more northern infestations during late July. Migrating aphids are usually all

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Soybean Aphids Found in North Missouri *continued from page 110*

females which are capable of producing 3-8 female offspring per day for a 1 month period. These offspring are all female, born pregnant, and give live birth instead of laying eggs. This allows soybean aphids to rapidly reproduce with populations often doubling every 2-3 days when conditions are favorable. A total of up to 18 generations of soybean aphids may be produced during a single crop season in more northern states with few generations produced in Missouri after migrating aphids arrive during July. Spring infestations of soybean aphid occasionally occur in Missouri from overwintering soybean aphid eggs laid on several species of buckthorn (Rhamnus spp.). Whether spring infestations of this pest occur in Missouri are often determined by the rate of egg mortality caused by several beneficial insects while eggs are on the overwintering hosts. Ladybird beetles (ladybugs) typically cause the greatest amounts of egg mortality.

Figure 1. Soybean Aphid (Photo by Claudio Gratton)

Producers are encourage to treat soybean aphid populations only after they have reached or exceeded the economic threshold of 250 aphids or more per plant during plant growth stages of R1

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Table 1. Soybean Aphid

Soybean Aphid			
Comments: Treat when 250 or more aphids are present per plant when soybean plants are in the R1 through R5 growth stages. Larger yield responses will be realized when the insecticide is applied closer to the R1 stage of growth as compared to later growth stages. In Missouri, beneficial insects are very important and can often control light to moderate soybean aphid infestations if given an opportunity to do so.			
Common Name	***Trade Name***	***Rate of formulated material per acre***	***Placement***
esfenvalerate	***Asana XL**	5.8 to 9.6 fl. oz.	On foliage
cyfluthrin	***Baythroid XL**	2.0 to 2.8 fl. oz.	On foliage
bifenthrin	***Brigade 2 EC**	2.1 to 6.4 fl. oz.	On foliage
chlorpyrifos + gamma-cyhalothrin	***Cobalt**	13 to 26 fl. oz.	On foliage
carbofuran	***Furadan 4F**	1/2 pt. (See note below**)	On foliage
zeta-cypermethrin +	***Hero**	4.0 to 10.3 fl. oz	On foliage
chlorpyrifos	***Lorsban 4E**	1 to 2 pt.	On foliage
zeta-cypermethrin	***Mustang Max**	3.2 to 4.0 fl. oz.	On foliage
chlorpyrifos	***Nufos 4E**	1 to 2 pt.	On foliage
acephate	**Orthene 97**	3/4 to 1 lb.	On foliage
microencapsulated methyl parathion	***Penncap-M**	1 to 3 pt.	On foliage
permethrin	***Pounce 3.2EC**	4.0 to 8.0 fl. oz	On foliage
gamma-cyhalothrin	***Proaxis**	1.92 to 3.2 fl. oz.	On foliage
lambda-cyhalothrin	***Warrior**	1.92 to 3.2 fl. oz.	On foliage

***Designates a restricted-use pesticide. Use is restricted to certified applicators only.** Regardless of the formulation selected, read the label to determine appropriated insecticide rates, directions, precautions, and restrictions.
****Furadan 4F** produced and labeled before 2009 season may still be used until **December 31, 2009**.

and palmer amaranth as long as there is no PPO-resistance present in the population. Another option if you decide to stay with soybeans is to utilize LibertyLink soybeans and Ignite. However, even if a grower chooses to utilize this new mode-of-action in soybeans, I would still start with a preemergence herbicide and follow this with a timely application of Ignite.

Second, if you have a glyphosate-resistant weed like waterhemp or palmer pigweed you can rotate away from soybeans altogether. For example, rotate to a conventional corn hybrid and use alternative herbicides in this system for at least one year or perhaps two in an attempt to reduce the glyphosate-resistant weed seedbank. In our research with glyphosate-resistant waterhemp, we have found that most prepackaged atrazine and chloroacetamide mixtures will provide excellent control of glyphosate-resistant waterhemp in corn. Additionally, we have observed excellent control of glyphosate-resistant waterhemp in corn with postemergence herbicides like Distinct, Status, Callisto, Impact, Laudis, and others.

Glyphosate and Roundup Ready crops have simplified weed management in soybeans dramatically over the past decade. They have enabled us, for the most part, to achieve excellent weed control at an economical price. In order to preserve the utility of this technology, growers must be willing to adapt and change their practices when situations like glyphosate resistance arise. In fields where glyphosate-resistant weeds are suspected or are present in only small areas, paying a little more now through the use of an alternative herbicide or different cropping system will be much better than allowing these weeds to proliferate and develop into a much bigger problem in the long run.

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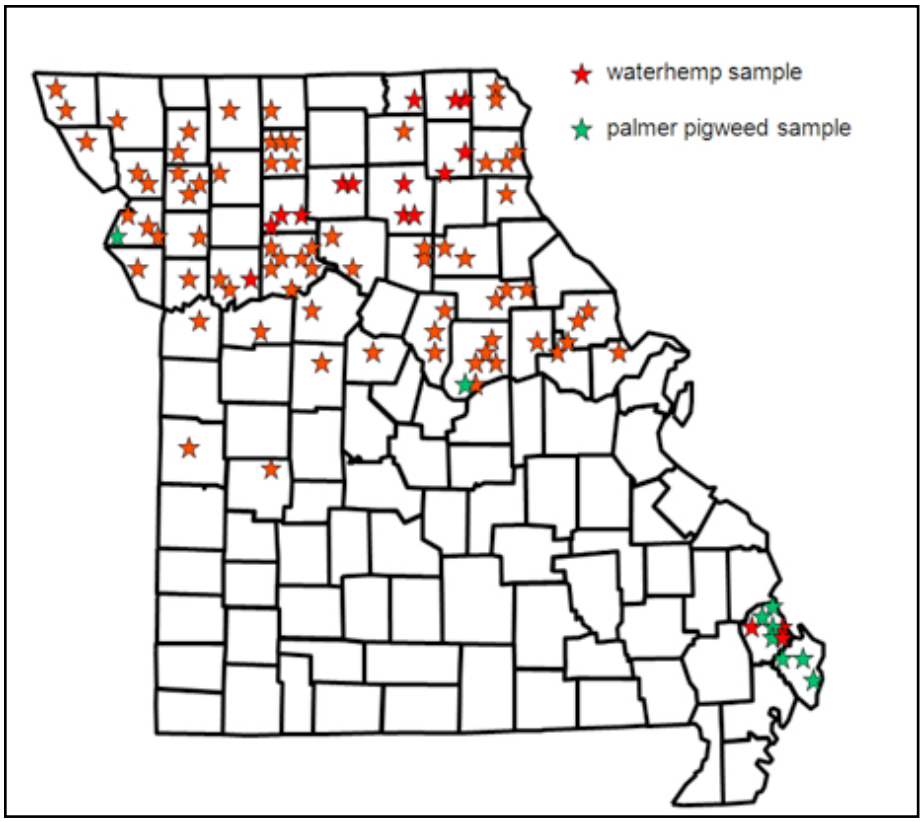

Figure 1. Location of waterhemp and palmer pigweed seed samples collected in 2008 for determination of glyphosate resistance.

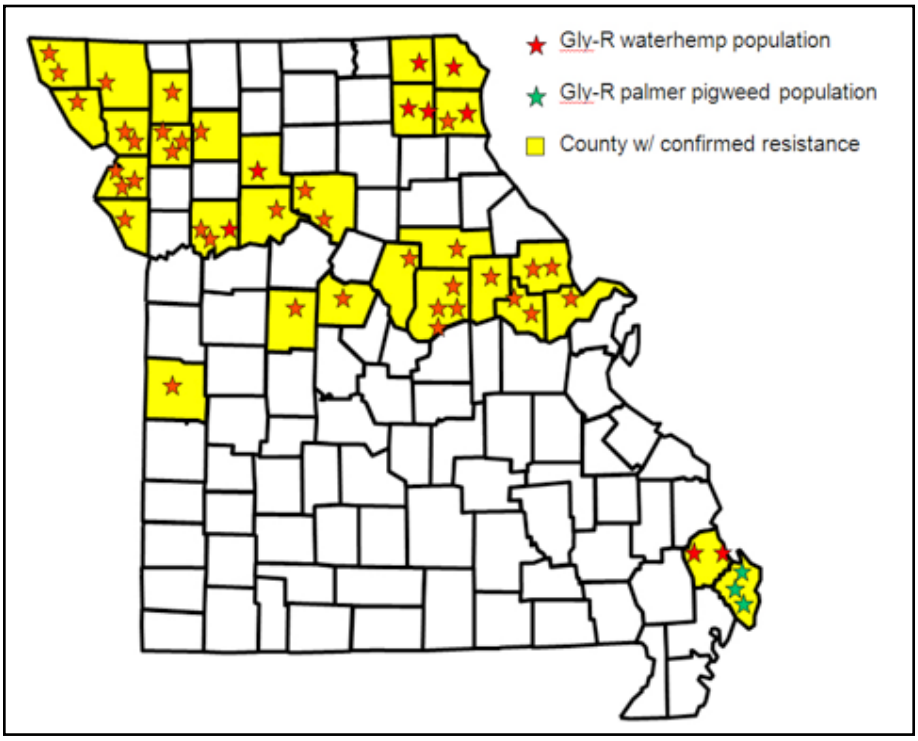

Figure 2. Confirmed glyphosate-resistant waterhemp and palmer pigweed populations present in Missouri.

(flowering) through R5 (seed fill). At present, higher populations of aphids can be found on late planted soybean and on fields of soybean growing under potassium deficient conditions. Older plants past the R5 stage of growth may support soybean aphid populations, but data from more northern states suggest they have little impact on yield once the soybean plants move past the R5 growth stage. Although the entire plant should be inspected to determine total aphid numbers, most aphids will be found on the stems and underside of soybean leaves. Newer plant tissue is often preferred as feeding sites.

Several insecticides are labeled for control of soybean aphid on soybean. The following table provides a list of recommended insecticides and use rates. In trials in more northern states where soybean aphids are a very severe problem, it has been observed that insecticides in the pyrethroid class (Asana XL, Baythroid 2, Mustang Max, Proaxis, and Warrior) provide from 2-4 weeks of residual activity, but may require from 24 to 72 hours to initially kill the aphid. In contrast, organophosphate insecticides (Lorsban, Nufos,) and carbamate insecticides (Furadan) provide for quick knockdown of the aphid population, but have a lesser period of residual control which may vary from 7 – 21 days postapplication depending on the rate of insecticide applied and specific field conditions. In some areas of the Midwest "cocktail" mixes are sometimes used for soybean aphid control. A "cocktail" mix will contain both a pyrethroid class of insecticide for long residual combined with an organophosphate or carbamate insecticide for quicker knockdown of the pest. Under Missouri conditions any of the labeled insecticides should provide good control for soybean aphid.

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Weather Data for the Week Ending August 3, 2009

By Pat Guinan

Station	County	Weekly Temperature (°F)						Monthly Precipitation (in.)		Growing Degree Days‡	
		Avg. Max.	Avg. Min.	Extreme High	Extreme Low	Mean	Departure from long term avg.	July 1 - July 31	Departure from long term avg.	Accumulated Since Apr. 1	Departure from long term avg.
Corning	Atchison	82	58	93	53	71	-6	2.77	-2.29	2095	+15
St. Joseph	Buchanan	79	61	89	58	70	-7	4.86	+0.29	2033	-56
Brunswick	Carroll	81	59	91	51	70	-7	3.10	-1.07	2100	-24
Albany	Gentry	82	57	91	52	71	-6	2.67	-2.45	1959	-112
Auxvasse	Audrain	83	60	92	55	71	-6	3.15	-0.80	2094	-49
Vandalia	Audrain	83	60	92	55	71	-6	3.08	-1.36	2078	-37
Columbia-Bradford	Boone	82	60	92	56	71	-7	5.05	+0.93	*	*
Columbia-Jefferson Farm	Boone	82	61	91	56	72	-6	4.93	+0.83	2123	-94
Columbia-South Farms	Boone	82	61	92	55	71	-7	5.26	+1.14	2120	-97
Williamsburg	Callaway	84	60	93	54	71	-6	4.26	+0.01	2075	-17
Novelty	Knox	80	59	88	55	69	-7	4.24	+0.10	1875	-203
Linneus	Linn	81	57	91	53	69	-7	4.19	-0.68	1939	-90
Monroe City	Monroe	82	60	91	54	70	-7	2.44	-1.38	1999	-125
Versailles	Morgan	84	61	95	56	72	-6	6.07	+1.96	2236	-21
Green Ridge	Pettis	82	60	92	53	71	-2	3.27	-0.70	2132	+33
Lamar	Barton	83	61	93	54	72	-7	4.68	+0.35	2256	-87
Cook Station	Crawford	84	60	94	54	71	-7	2.09	-1.39	2062	-214
Round Spring	Shannon	84	61	92	54	71	-6	2.53	-1.43	2094	-70
Mountain Grove	Wright	82	61	90	56	71	-6	4.09	-0.18	2042	-84
Delta	Cape Girardeau	84	64	89	57	74	-5	2.19	-1.19	2364	-172
Cardwell	Dunklin	82	68	90	65	74	-6	9.78	+6.32	2648	-106
Clarkton	Dunklin	82	67	90	63	74	-6	3.65	+0.09	2559	-160
Glennonville	Dunklin	83	67	91	64	75	-5	4.88	+1.37	2582	-126
Charleston	Mississippi	86	66	90	63	75	-4	4.39	+0.46	2495	-23
Portageville-Delta Center	Pemiscot	83	68	90	66	75	-5	4.40	+1.04	2673	-47
Portageville-Lee Farm	Pemiscot	84	68	92	66	76	-4	4.54	+0.92	2686	-16
Steele	Pemiscot	82	68	90	66	75	-5	6.59	+2.91	2748	+22

* 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.

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