

## HERBICIDE-RESISTANT WEEDS

Weed resistance has been documented or reported in Mississippi and surrounding states for several herbicides (see list below). Because present economical weed management programs are predominantly herbicide-dependent, there is a real and immediate need to reduce and/or prevent the likelihood of selecting herbicide-resistant weeds. Development of herbicide-resistant weeds in herbicide-resistant crops, such as crops that are resistant to bromoxynil, glyphosate, glufosinate, imazethapyr, and sethoxydim, may also be possible. Growers should also recognize the selection pressure being placed on herbicide-resistant weed development when nonselective herbicides such as glyphosate are used as both a preplant-burndown and in-crop program. Herbicides users must incorporate practices such as the inclusion of nonchemical (tillage) weed-control methods. They must also rotate herbicides and herbicide families with different modes of action within a given weed management and/or cropping situation. The inclusion of an herbicide-resistant crop, in conjunction with previously mentioned practices, into an existing non-herbicide-resistant crop rotation system may also reduce the risk of selecting for herbicide-resistant weeds. Crop rotation will (in most situations) dictate herbicide and/or herbicide-family rotation. In monocrop, noncrop, or other weed-control situations, herbicides and/or herbicide families should be rotated. Monocrop

situations include herbicide-resistant cropping systems. In fields where resistance has been confirmed, the following practices may be considered for control of resistant weeds: (1) use an effective preemergence herbicide to control seedlings; (2) use different chemical families from those used in previous years when post-emergence herbicides are applied; and (3) rotate to a different cropping system such as a herbicide-resistant or non-herbicide-resistant crop when resistant weeds have developed in different cropping systems. Minimize spread by using herbicides from different chemical families, by preventing weeds from producing seed, and by cleaning all equipment of seed and/or rhizomes before leaving the field. These measures represent the most immediate and effective means of preventing or reducing potentially serious problems with weeds resistant to currently used herbicides.

Herbicide resistance is not usually the cause of unsatisfactory weed control. Weeds may not be controlled in an herbicide-treated field or area because of many factors, including poor soil incorporation, stressful growing conditions, skips in application, inadequate rainfall for activation, or excessive rainfall that causes the herbicide to move out of the weed seed zone. Before resistance is considered as the cause of lack of weed control, first rule out all other reasons for poor herbicide performance.

<b>Weed</b>	<b>Herbicide</b>
Barnyardgrass	propanil
Common cocklebur	MSMA and DSMA, imazaquin, imazethapyr
Goosegrass	trifluralin and pendimethalin, MSMA and DSMA
Johnsongrass	trifluralin and pendimethalin, fluazifop-P, quizalofop-P, fexxaprop
Annual ryegrass	metsulfuron and sulfometuron, diclofop
Annual bluegrass	simazine
Horseweed (mare's-tail)	glyphosate
Pigweed species	sulfometuron
Palmer amaranth	glyphosate
Italian ryegrass	glyphosate, metsulfuron, sulfometuron, imazapic, imazapyr
Johnsongrass	glyphosate

### **2009 Weed Resistance Survey**

A survey of the Mississippi Delta was conducted to determine the occurrence and distribution of herbicide-resistant weeds. Data from completed glyphosate resistance screening studies is shown below:

<b>Weed</b>	<b>County (containing at least one resistant population)</b>
Italian ryegrass	Bolivar, Coahoma, Humphreys, Issaquena, Leflore, Panola, Quitman, Sharkey, Sunflower, Tunica, Washington, and Yazoo
Palmer amaranth	Bolivar, Coahoma, Desoto, Panola, Quitman, Sunflower, Tallahatchie, Tunica, and Washington
Waterhemp	Bolivar

Weed populations suspected to be resistant to glyphosate and/or other herbicides may be reported to Vijay Nandula, PO Box 197, Stoneville, MS 38776; Telephone, (662) 686-3271; e-mail, vnandula@drec.msstate.edu.

## **Management Options for Glyphosate-Resistant Weeds in Soybean**

These are suggested options for management of glyphosate-resistant weeds in soybean. These are not the only options, but they have proven to be effective at managing glyphosate-resistant weeds in soybean in Mississippi. Please see the overall herbicide resistance summary in this section for details on existing herbicide-resistant weeds and their distribution in Mississippi.

<b>Weed</b>	<b>Herbicide(s)</b>	<b>Rate</b>	<b>Timing of application</b>	<b>Special instructions</b>
Horseweed	Valor XLT	3 oz/A	Fall to spring burndown but before soybean emergence	Apply before horseweed emerges. If horseweed has emerged, add 2,4-D or dicamba product to control existing horseweed that emerged before application. If 2,4-D or dicamba is applied in the spring, see label for soybean plant-back restrictions. If applied with 2,4-D or dicamba, add 1% crop oil or 0.25% nonionic surfactant. See Valor XLT in the soybean preemergence section for additional information.
Horseweed	Gangster	2.4 oz/A (2 oz Valor + 0.4 oz FirstRate). Sold as a co-pack	Fall to spring burndown but before soybean emergence	Apply before horseweed emerges. If horseweed has emerged, add 2,4-D or dicamba product to control existing horseweed that emerged before application. If 2,4-D or dicamba is applied in the spring, see label for soybean plant-back restrictions. If applied with 2,4-D or dicamba, add 1% crop oil or 0.25% nonionic surfactant. See Gangster in the soybean preemergence section for additional information.
Horseweed	Canopy	4–6 oz/A	Fall to spring burndown up to planting	Apply before horseweed emerges. If horseweed has emerged, add 2,4-D or dicamba product to control existing horseweed that emerged before application. If 2,4-D or dicamba is applied in the spring, see the label for soybean plant-back restrictions. If applied with 2,4-D or dicamba, add 1% crop oil or 0.25% nonionic surfactant. See Canopy in the soybean preemergence section for additional information.
Horseweed	Envive	3 oz/A	Fall to spring burndown up to planting	Apply before horseweed emerges. If horseweed has emerged, add 2,4-D or dicamba product to control existing horseweed that emerged before application. If applied with 2,4-D or dicamba, add 1% crop oil or 0.25% nonionic surfactant. See Envive in the soybean preemergence section for additional information.
Horseweed	Canopy EX	2 oz/A	Fall to spring burndown up to 7 days before planting	Apply before horseweed emerges. If horseweed has emerged, add 2,4-D or dicamba product to control existing horseweed that emerged before application. If applied with 2,4-D or dicamba, add 1% crop oil or 0.25% nonionic surfactant. See Canopy EX in the soybean preemergence section for additional information.
Horseweed	Valor	2 oz/A	Fall to spring burndown but before soybean emergence	Apply before horseweed emerges. If horseweed has emerged, add 2,4-D or dicamba product to control existing horseweed that emerged before application. If applied with 2,4-D or dicamba, add 1% crop oil or 0.25% nonionic surfactant. See Valor in the soybean preemergence section for additional information.

<b>Weed</b>	<b>Herbicide(s)</b>	<b>Rate</b>	<b>Timing of application</b>	<b>Special instructions</b>
Horseweed	FirstRate	0.75 oz/A	Fall to spring burndown but before crop emerges	Apply before horseweed emerges. If horseweed has emerged, add 2,4-D or dicamba product to control existing horseweed that emerged before application. If applied with 2,4-D or dicamba, add 1% crop oil or 0.25% nonionic surfactant. Do not exceed 1.05 ounces per acre in a single season.
Horseweed	Python	1–1.33 oz/A	Up to 30 days before planting but before soybean emergence	Apply before horseweed emerges. If horseweed has emerged, add 2,4-D or dicamba product to control existing horseweed that emerged before application. If applied with 2,4-D or dicamba, add 1% crop oil or 0.25% nonionic surfactant.
Horseweed	2,4-D	Formulation dependant	Fall to spring burndown but 7 to 30 days before planting, depending on formulation	Apply alone or with residual product listed above for control of horseweed emerged at time of application. This option does not provide residual control of horseweed. It is often applied with glyphosate or glyphosate + residual herbicide in a spring burndown program.
Horseweed	dicamba Banvel, (Clarity, or other formulation)	Formulation dependant	Fall to spring burndown; must wait at least 30 days before planting soybean after 1 inch or more of rain after application	Apply alone or with residual product listed above for control of horseweed emerged at time of application. This option does not provide residual control of horseweed. Often applied with glyphosate or glyphosate + residual herbicide in a spring burndown program.
Horseweed	Ignite	22–36 fl oz/A	Fall to spring burndown but before soybean emergence	Ignite is often applied at planting as a salvage treatment. Level of control is dependent upon size and age of horseweed, spray coverage, and air temperature. Daytime air temperature should be at least 70°F at application and for at least 3 to 4 days after application.
Horseweed	FirstRate	0.3–0.6 oz/A	From planting up to 50% flowering soybean	FirstRate can be applied over the top of soybean and horseweed at 0.3 ounce per acre. A second application of 0.3 ounce can be applied 10 to 14 days after first application to control existing weeds and provide longer residual activity. A single application of 0.6 ounce per acre can be applied under extreme weed pressure. Do not exceed 1.05 ounces per acre in a single season. Apply at least 10 gallons of water per acre.
	or glyphosate + FirstRate	Formulation dependent + 0.3 to 0.6 oz/A	From planting up to 50% flowering soybean	If applied with glyphosate formulation pre-loaded with an adjuvant, no additional adjuvant is required. However, improved control has been observed when an additional adjuvant is used along with the adjuvant in the pre-loaded glyphosate formulation.
Horseweed	Sharpen	1–2 oz/A	Fall to spring burndown but before soybean emergence	Horseweed should be less than 6 inches in diameter or height. Sharpen will provide some residual control of horseweed. It may be tank-mixed with glyphosate, paraquat, or glufosinate to improve grass and broadleaf control. Always add 1% v/v methylated seed oil (MSO). Addition of AMS at 1–2% w/v water is recommended. Severe crop injury will occur if you apply when soybean has reached cracking stage or after emergence. Use the 1-ounce rate when it is less than 30 days before planting. Do not apply preemergence to coarse soils. Do not apply more than 2 ounces per season.

<b>Weed</b>	<b>Herbicide(s)</b>	<b>Rate</b>	<b>Timing of application</b>	<b>Special instructions</b>
Horseweed	Synchrony XP	1.125 oz/A (STS soybean only)	<b>STS soybean only:</b> at planting to early postemergence over the top of STS soybean	Synchrony XP may provide inconsistent and incomplete control or suppression only. Using this treatment repetitively across years likely will lead to development of resistance to ALS herbicides such as Synchrony XP. For use only on STS soybean varieties when applying the 1.125-ounce rate postemergence.
	or glyphosate + Synchrony XP	Formulation dependant + 1.125 oz/A (STS soybean only)	<b>STS soybean only:</b> at planting to early postemergence over the top of STS soybean	If applied with glyphosate formulation pre-loaded with an adjuvant, no additional adjuvant is required. However, improved control has been observed when an additional adjuvant is used along with the adjuvant in the pre-loaded glyphosate formulation.
Italian ryegrass	Dual Magnum	1.33–1.66 pt/A	Fall before ryegrass emergence	The rate is soil-type dependant; see the table in the Dual Magnum entry in the soybean pre-emergence section for rate information. If applied after ryegrass has emerged, apply with at least 3 pints per acre of Gramoxone Inteon. Gramoxone Inteon should be applied in at least 15 gallons of water by ground and with 1% crop oil or 0.25% nonionic surfactant.
Italian ryegrass	Command	1.33–2.66 pt/A	Fall before ryegrass emergence	If applied after ryegrass has emerged, apply with at least 3 pints per acre of Gramoxone Inteon. Gramoxone Inteon should be applied in at least 15 gallons of water by ground and with 1% crop oil or 0.25% nonionic surfactant. Command has a 9-month rotation restriction for corn. See the label for more instructions.
Italian ryegrass	Gramoxone Inteon	2.5–4 pt/A	Control existing Italian ryegrass; apply before soybean emergence — will kill emerged soybean	Apply to control emerged Italian ryegrass. Spray volume is critical. Apply in at least 15 gallons of water per acre. Avoid air induction nozzles. Does not provide residual control. Add 1% crop oil or 0.5% nonionic surfactant.
Italian ryegrass	Select Max	9–16 fl oz/A	Apply to small Italian ryegrass before it exceeds 6 inches in height; apply in an early burndown program (late January to early March)	Do not apply under cold conditions. Daytime air temperature should be at least 60°F at application and for at least 3 to 4 days after application. Add 0.25% nonionic surfactant or 1% crop oil if applying alone or with a glyphosate formulation not preloaded with an adjuvant. If applied with glyphosate formulation preloaded with an adjuvant, no additional adjuvant is required.
Palmer pigweed	Valor	2 oz/A	Within 30 days of planting but before crop emergence	Injury to soybean can occur if rain falls soon after crop emergence, especially on sandy or silt loam soils. Valor provides residual control of Palmer pigweed into the growing season but not season-long control. Control is dependent upon activation of herbicide and level of weed infestation. It only provides residual control and does not control existing weeds. See Valor in the soybean preemergence section for additional information.
Palmer pigweed	Valor XLT	3 oz/A	Prior to or after planting but before soybean emergence.	Injury to soybean can occur if rain falls soon after crop emergence, especially on sandy or silt loam soils. Valor XLT provides residual control of Palmer pigweed into the growing season but not season-long control. Control is dependent upon activation of herbicide and level of weed infestation. It only provides residual control and does not control existing weeds. See Valor XLT in the soybean pre-emergence section for additional information.

Weed	Herbicide(s)	Rate	Timing of application	Special instructions
Palmer pigweed	Envive	3 oz/A	Prior to or after planting but before soybean emergence.	Injury to soybean can occur if rain falls soon after crop emergence, especially on sandy or silt loam soils. Envive provides residual control of Palmer pigweed into the growing season but not season-long control. Control is dependent upon activation of herbicide and level of weed infestation. It only provides residual control and does not control existing weeds. See Envive in the soybean preemergence section for additional information.
Palmer pigweed	Gangster	2.4 oz/A (2 oz Valor + 0.4 oz FirstRate). Sold as a co-pack	Prior to or after planting but before soybean emergence.	Injury to soybean can occur if rain falls soon after crop emergence, especially on sandy or silt loam soils. Gangster provides residual control of Palmer pigweed into the growing season but not season-long control. Control is dependent upon activation of herbicide and level of weed infestation. It only provides residual control and does not control existing weeds. See Gangster in the soybean preemergence section for additional information.
Palmer pigweed	Canopy	4–6 oz/A	Prior to or after planting but before soybean emergence.	Injury to soybean can occur if rain falls soon after crop emergence, especially on sandy or silt loam soils. Canopy provides residual control of Palmer pigweed into the growing season but not season-long control. Control is dependent upon activation of herbicide and level of weed infestation. It only provides residual control and does not control existing weeds. See Canopy in the soybean preemergence section for additional information.
Palmer pigweed	Python	1– 1.33 oz/A	Up to 30 days before planting but before soybean emergence	Injury to soybean can occur if rain falls soon after crop emergence, especially on sandy or silt loam soils. Python provides residual control of Palmer pigweed into the growing season but not season-long control. Control is dependent upon activation of herbicide and level of weed infestation. It only provides residual control and does not control existing weeds. See Python in the soybean preemergence section for additional information.
Palmer pigweed	Prefix or <b>POST application:</b> Prefix + glyphosate	2 pt/A  <b>POST application:</b> 2 pt/A + recommended glyphosate rate according to product label	At planting but before crop emergence  <b>POST application:</b> Apply when soybean has one to three trifoliolate leaves	Injury to soybean can occur if rain falls soon after crop emergence, especially on sandy or silt loam soils. Prefix provides residual control of Palmer pigweed into the growing season but not season-long control. Control is dependent upon activation of herbicide and level of weed infestation. Prefix provides primarily residual control, but it also provides partial control of existing Palmer pigweed, with level of control dependent upon weed size (should have no more than four leaves). Glyphosate can be added to control existing vegetation.
Palmer pigweed	metolachlor/ S-metolachlor or <b>POST application:</b> metolachlor + glyphosate or Sequence	Formulation dependant  <b>POST application:</b> Dependent on formulation (see specific labels) or 2.5– 3 pt/A of Sequence	At planting  <b>POST application:</b> From soybean planting through third soybean trifoliolate growth stage	This option provides only residual control. See the metolachlor entry in the soybean preemergence section for rates.  Apply with glyphosate or Sequence (pre-mixture of glyphosate + S-metolachlor) alone. Add 0.25% nonionic surfactant when applying glyphosate with metolachlor. No additional adjuvant is needed when applying Sequence. Metolachlor or S-metolachlor provides residual control of Palmer pigweed into the growing season but not season-long control. Control is dependent upon activation of herbicide and level of weed infestation.

<b>Weed</b>	<b>Herbicide(s)</b>	<b>Rate</b>	<b>Timing of application</b>	<b>Special instructions</b>
Palmer pigweed	Reflex or Flexstar	1–1.5 pt/A	Apply over the top of soybean any time prior to 45 days before soybean harvest	Rate applied depends on weed size. Apply 1 to 1.25 pints per acre before Palmer pigweed has more than four true leaves. Apply 1.5 pints before Palmer pigweed has more than six true leaves. Marginal control can be expected when Palmer pigweed exceeds the six-leaf growth stage. Add 0.25% nonionic surfactant. Spray coverage is critical; apply in at least 15 gallons of water per acre.
	or Glyphosate + Reflex or Flexstar	Glyphosate rate dependent upon formulation (see specific glyphosate label for rate) + 6–12 fl oz/A of Reflex or Flexstar	Apply over the top of soybean any time prior to 45 days before soybean harvest	When applying with a glyphosate formulation preloaded with an adjuvant, an additional adjuvant is not required. When applying with a glyphosate formulation not preloaded with a glyphosate formulation, add 0.25% non-ionic surfactant.
Johnsongrass (rhizome)	Select Max	12–32 fl oz/A	Anytime to emerged Johnsongrass	Apply to Johnsongrass before it reaches 25 inches in height. Reduced level of control can be expected on larger Johnsongrass.
		9–24 fl oz/A for repeat application to control regrowth		Apply a follow-up application to regrowth after first application if needed, but apply to Johnsongrass no larger than 18 inches in height.  Apply in at least 10 gallons of water by ground. Add 0.25% nonionic surfactant or 1% crop oil if applying alone or with a glyphosate formulation not preloaded with an adjuvant. If applied with glyphosate formulation preloaded with an adjuvant, no additional adjuvant is required.
Johnsongrass (rhizome)	Assure II	10 fl oz/A for single application followed by 7 fl oz/A for control of regrowth	Apply to 10- to 24-inch Johnsongrass and 6- to 10-inch Johnsongrass for the sequential application	Add 0.25% nonionic surfactant or 1% crop oil to spray solution. Apply in at least 10 gallons of water per acre. If applied with glyphosate formulation preloaded with an adjuvant, no additional adjuvant is required by label.
Johnsongrass (rhizome)	Fusilade DX	12 fl oz/A followed by 8 fl oz/A to control regrowth	Apply to Johnsongrass up to 18 inches tall with 12 fl oz/A rate and up to 12 inches tall with the follow-up application	Add 0.25% nonionic surfactant or 1% crop oil to spray solution. Apply in at least 10 gallons of water per acre. If applied with glyphosate formulation preloaded with an adjuvant, no additional adjuvant is required by label.
Johnsongrass (rhizome)	Poast Plus	24 fl oz/A followed by 24 fl oz/A to control regrowth	Apply to Johnsongrass up to 20 inches tall with 24 fl oz/A rate and up to 10 inches tall with the follow-up application	Add 1% crop oil to the spray solution. Apply in at least 10 gallons of water per acre. If applied with glyphosate formulation preloaded with an adjuvant, no additional adjuvant is required by label.