

# Corn and Soybean Herbicide Chart

Repeated use of herbicides with the same site of action can result in the development of herbicide-resistant weed populations.

## By Mode of Action (effect on plant growth)

This chart groups herbicides by their modes of action to assist you in selecting herbicides **1)** to maintain greater diversity in herbicide use and **2)** to rotate among herbicides with different sites of action to delay the development of herbicide resistance.

The Site of Action Group is a classification system developed by the Weed Science Society of America.

Site of Action Group	Site of Action	Number of resistant weed species in U.S.	Chemical Family	Active Ingredient	Product Examples (Trade Name ®)
<b>1</b>	ACCase Inhibitors (acetyl CoA carboxylase)	<b>15</b>	Aryloxyphenoxy propionate	fenoxaprop fluaazifop quizalofop	component of <i>Fusion</i> <i>Fusilade DX</i> <i>Assure II, Targa</i>
			Cyclohexanedione	clethodim sethoxydim	<i>Select, Arrow</i> <i>Poast, Poast Plus</i>
<b>2</b>	ALS Inhibitors (acetolactate synthase)	<b>44</b>	Sulfonylurea	chlorimuron foramsulfuron halosulfuron iodosulfuron nicosulfuron	<i>Classic</i> <i>Option</i> <i>Permit</i> <i>Autumn</i> <i>Accent Q</i>

Lipid Synthesis Inhibitors

This chart lists premix herbicides alphabetically by their trade names so you can identify the premix's component herbicides and their respective site of action groups. Refer to the **Mode of Action** chart on the left for more information.

Premix Trade Name ®	Trade Name ®	Component Active Ingredient	Site of Action Group
Anthem	<i>Zidua</i>	pyroxasulfone	15
	<i>Cadet</i>	fluthiacet-ethyl	14
Authority Assist	<i>Spartan</i>	sulfentrazone	14
	<i>Pursuit</i>	imazethapyr	2
Authority First	<i>Spartan</i>	sulfentrazone	14
	<i>FirstRate</i>	cloransulam	2
Authority MTZ	<i>Spartan</i>	sulfentrazone	14
	<i>Sencor</i>	metribuzin	5
Authority XL	<i>Spartan</i>	sulfentrazone	14
	<i>Classic</i>	chlorimuron	2
Autumn Super	<i>Autumn</i>	iodosulfuron	2
		thiencarbazone	2
Basis Blend	<i>Resolve</i>	rimsulfuron	2
	<i>Harmony</i>	thifensulfuron	2
Bicep II Magnum (Bicep Lite II Mag)	<i>Dual II Magnum</i>	s-metolachlor	15
	<i>AAtrex</i>	atrazine	5
Boundary	<i>Dual Magnum</i>	s-metolachlor	15
	<i>Sencor</i>	metribuzin	5
Breakfree ATZ (Breakfree ATZ Lite)	<i>Breakfree</i>	acetochlor	15
	<i>AAtrex</i>	atrazine	5
Bullet	<i>Micro-Tech</i>	alachlor	15
	<i>AAtrex</i>	atrazine	5
Callisto Xtra	<i>Callisto</i>	mesotrione	27
	<i>AAtrex</i>	atrazine	5
Canopy	<i>Classic</i>	chlorimuron	2
	<i>Sencor</i>	metribuzin	5
Canopy EX	<i>Classic</i>	chlorimuron	2
	<i>Express</i>	tribenuron	2
Capreno	<i>Laudis</i>	thiencarbazone	2
		tembotrione	27
Cinch ATZ (Cinch ATZ Lite)	<i>Dual II Magnum</i>	s-metolachlor	15
	<i>AAtrex</i>	atrazine	5
Corvus	<i>Balance Flexx</i>	thiencarbazone	2
		isoxaflutole	27
Degree Xtra	<i>Degree</i>	acetochlor	15
	<i>AAtrex</i>	atrazine	5
Enlite	<i>Classic</i>	chlorimuron	2
	<i>Harmony</i>	thifensulfuron	2
	<i>Valor</i>	flumioxazin	14

## Amino Acid Synthesis Inhibitors

<b>9</b>	<b>EPSP Synthase Inhibitor</b> (5-enolpyruvyl-shikimate-3-phosphate)	<b>13</b>	None accepted	glyphosate	<b>Roundup, Touchdown, others</b>
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## Growth Regulators (Synthetic auxins)

<b>4</b>	<b>Specific site unknown</b>	<b>10</b>	Phenoxy	2,4-D	<b>Weedone, others</b>
			Benzoic acid	dicamba	<b>Banvel, Clarity, others</b>
			Carboxylic acid	clopyralid fluroxypyr	<b>Stinger Starane</b>
<b>19</b>	<b>Auxin Transport</b>	<b>0</b>	Semicarbazone	diflufenzopyr	component of <b>Status</b>

## Photo-synthesis Inhibitors

<b>5</b>	<b>Photosystem II Inhibitors</b> (different binding than 6 & 7)	<b>24</b>	Triazine	atrazine simazine	<b>AAtrex, others Princep</b>
			Triazinone	metribuzin	<b>Sencor, others</b>
<b>6</b>	<b>Photosystem II Inhibitors</b> (different binding than 5 & 7)	<b>1</b>	Nitrile	bromoxynil	<b>Buctril, Moxy</b>
			Benzothiadiazole	bentazon	<b>Basagran</b>
<b>7</b>	<b>Photosystem II Inhibitors</b> (different binding than 5 & 6)	<b>7</b>	Ureas	linuron	<b>Lorox, Linex</b>

## Nitrogen Metabolism

<b>10</b>	<b>Glutamine Synthesis Inhibitor</b>	None accepted	glufosinate	<b>Liberty</b>
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## Pigment Inhibitors

<b>13</b>	<b>Diterpene Synthesis Inhibitor</b>	<b>1</b>	Isoxazolidinone	clomazone	<b>Command</b>
<b>27</b>	<b>HPPD Inhibitors</b>	<b>1</b>	Isoxazole	isoxaflutole	<b>Balance Flexx</b>

primisulfuron  
prosulfuron  
rimsulfuron  
thifensulfuron  
tribenuron

**Beacon  
Peak  
Resolve  
Harmony  
Express**

Imidazolinone

imazamox  
imazaquin  
imazethapyr

**Raptor  
Scepter  
Pursuit**

Triazolopyrimidine

flumetsulam  
cloransulam  
thiencarbazone

**Python  
FirstRate**  
component of **Capreno**

Triazolinones

Envive	<b>Classic</b>	chlorimuron	2	
	<b>Harmony</b>	thifensulfuron	2	
	<b>Valor</b>	flumioxazin	14	
Expert	<b>Dual II Magnum</b>	s-metolachlor	15	
	<b>AAtrex</b>	atrazine	5	
	<b>glyphosate</b>	glyphosate	9	
Exteme	<b>Pursuit</b>	imazethapyr	2	
	<b>glyphosate</b>	glyphosate	9	
Fierce	<b>Valor</b>	flumioxazin	14	
	<b>Zidua</b>	pyroxasulfone	15	
Fierce XLT*	<b>Valor</b>	flumioxazin	14	
	<b>Zidua</b>	pyroxasulfone	15	
	<b>Classic</b>	chlorimuron	2	
Flexstar GT	<b>Flexstar</b>	fomesafen	14	
	<b>glyphosate</b>	glyphosate	9	
Fusion	<b>Fusilade DX</b>	fluazifop	1	
	<b>Puma</b>	fenoxaprop	1	
Gangster	<b>Valor</b>	flumioxazin	14	
	<b>FirstRate</b>	cloransulam	2	
Guardsman Max (G-Max Lite)	<b>Outlook</b>	dimethenamid-P	15	
	<b>AAtrex</b>	atrazine	5	
Halex GT	<b>Dual Magnum</b>	s-metolachlor	15	
	<b>Callisto</b>	mesotrione	27	
	<b>glyphosate</b>	glyphosate	9	
Harness Xtra	<b>Harness</b>	acetochlor	15	
	<b>AAtrex</b>	atrazine	5	
Hornet	<b>Stinger</b>	clopyralid	4	
	<b>Python</b>	flumetsulam	2	
Instigate	<b>Resolve</b>	rimsulfuron	2	
	<b>Callisto</b>	mesotrione	27	
Keystone	<b>Surpass</b>	acetochlor	15	
(Keystone LA)	<b>AAtrex</b>	atrazine	5	
Lexar EZ	<b>Callisto</b>	mesotrione	27	
	<b>Dual II Magnum</b>	s-metolachlor	15	
	<b>AAtrex</b>	atrazine	5	
Lumax EZ	<b>Callisto</b>	mesotrione	27	
	<b>Dual II Magnum</b>	s-metolachlor	15	
	<b>AAtrex</b>	atrazine	5	
Marksman	<b>Clarity</b>	dicamba	4	
	<b>AAtrex</b>	atrazine	5	
NorthStar	<b>Beacon</b>	primisulfuron	2	
	<b>Clarity</b>	dicamba	4	
Optill	<b>Sharpen</b>	saflufenacil	14	
	<b>Pursuit</b>	imazethapyr	2	
Permit Plus	<b>Harmony</b>	thifensulfuron	2	
	<b>Permit</b>	halosulfuron	2	
Priority	<b>Aim</b>	carfentrazone	14	
	<b>Permit</b>	halosulfuron	2	
Prefix	<b>Dual Magnum</b>	s-metolachlor	15	
	<b>Reflex</b>	fomesafen	14	

Pyrazolone  
Triketone  
topramezone  
mesotrione  
tembotrione  
**Impact, Armezon  
Callisto  
Laudis**

**Cell  
Membrane  
Disrupters**

**14** PPO Inhibitors

**2** Diphenylether  
acifluorfen  
fomesafen  
lactofen  
**Ultra Blazer  
Flexstar, Reflex, others  
Cobra, Phoenix**

N-phenylphthalimide  
flumiclorac  
flumioxazin  
**Resource  
Valor**

Aryl triazinone  
sulfentrazone  
carfentrazone  
fluthiacet-ethyl  
saflufenacil  
**Spartan  
Aim  
Cadet  
Sharpen**

Pyrimidinedione  
Bipyridilium  
paraquat  
**Gramoxone Inteon**

**22** Photosystem I  
Electron Diverter

**3** Microtubule  
Inhibitors

**6** Dinitroaniline  
ethalfluralin  
pendimethalin  
trifluralin  
**Sonalan  
Prowl H<sub>2</sub>O, others  
Treflan, others**

**8** Lipid Synthesis  
Inhibitors  
(not ACCase)

**5** Thiocarbamate  
butylate  
EPTC  
**Sutan +  
Eradicane**

**15** Long-chain Fatty  
Acid Inhibitor

**1** Chloroacetamide  
acetochlor  
alachlor  
metolachlor  
dimethenamid  
**Degree, Harness, Surpass,  
Warrant, others  
Intro, Micro-Tech  
Dual II Magnum, others  
Outlook**

Oxyacetamide  
flufenacet  
**Define**

Pyrazole  
pyroxasulfone  
**Zidua**

**Seedling  
Root  
Growth  
Inhibitors**

**Seedling  
Shoot  
Growth  
Inhibitors**

\* indicates product is not registered for use at the time of printing. Check for a label and MSDS at [www.cdms.net](http://www.cdms.net) to confirm status.

**Glyphosate, Weeds, and Crop Series**

GWC-3

Distributed by weed scientists from 16 North Central Universities, who are working on weed management in glyphosate-resistant cropping systems. For information about obtaining copies of this publication and other resources, see [www.glyphosateweeds crops.org](http://www.glyphosateweeds crops.org)

Financial support for printing provided by BASF, Bayer CropScience, Dow AgroSciences, DuPont, Monsanto, Syngenta, and Valent USA. January 2013

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Prequel	<b>Resolve</b>	rimsulfuron	2	
	<b>Balance Flexx</b>	isoxaflutole	27	
Pursuit Plus	<b>Pursuit</b>	imazethapyr	2	
	<b>Prowl</b>	pendimethalin	3	
Realm Q	<b>Resolve</b>	rimsulfuron	2	
	<b>Callisto</b>	mesotrione	27	
Resolve Q	<b>Resolve</b>	rimsulfuron	2	
	<b>Harmony</b>	thifensulfuron	2	
Require Q	<b>Resolve</b>	rimsulfuron	2	
	<b>Clarity</b>	dicamba	4	
Rezult	<b>Basagran</b>	bentazon	6	
	<b>Poast</b>	sethoxydim	1	
Sequence	<b>Dual Magnum</b>	s-metolachlor	15	
	<b>glyphosate</b>	glyphosate	9	
Shotgun	<b>AAtrex</b>	atrazine	5	
	-----	2,4-D	4	
Sonic	<b>Spartan</b>	sulfentrazone	14	
	<b>FirstRate</b>	cloransulam	2	
Spartan Charge	<b>Spartan</b>	sulfentrazone	14	
	<b>Aim</b>	carfentrazone	14	
Spirit	<b>Peak</b>	prosulfuron	2	
	<b>Beacon</b>	primisulfuron	2	
Status	-----	diflufenzopyr	19	
	<b>Clarity</b>	dicamba	4	
Steadfast Q	<b>Accent Q</b>	nicosulfuron	2	
	<b>Resolve</b>	rimsulfuron	2	
SureStart	<b>Surpass</b>	acetochlor	15	
	<b>Stinger</b>	clopyralid	4	
	<b>Python</b>	flumetsulam	2	
Synchrony	<b>Classic</b>	chlorimuron	2	
	<b>Harmony</b>	thifensulfuron	2	
TripleFLEX	<b>Harness</b>	acetochlor	15	
	<b>Stinger</b>	clopyralid	4	
	<b>Python</b>	flumetsulam	2	
Valor XLT	<b>Valor</b>	flumioxazin	14	
	<b>Classic</b>	chlorimuron	2	
Verdict	<b>Sharpen</b>	saflufenacil	14	
	<b>Outlook</b>	dimethenamid-P	15	
Widematch	<b>Stinger</b>	clopyralid	4	
	<b>Starane</b>	fluroxypyr	4	
Yukon	<b>Banvel</b>	dicamba	4	
	<b>Permit</b>	halosulfuron	2	
Zemax	<b>Callisto</b>	mesotrione	27	
	<b>Dual II Magnum</b>	s-metolachlor	15	

Layout provided by the University of Wisconsin's Nutrient and Pest Management program ([ipcm.wisc.edu](http://ipcm.wisc.edu)).



## How to Effectively use the Corn and Soybean Herbicide Chart

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The message from weed scientists to producers to rotate and include multiple modes of action and sites of action in their corn and soybean herbicide programs has intensified with the increasing number of acres infested with herbicide resistant weeds. Along with that message have come many tools to help farmers ensure the proper rotation of herbicides, including the Corn and Soybean Herbicide Chart from the glyphosate weeds and crops working group. This chart has been distributed by university weed scientists to aid producers in determining herbicide programs with optimal site of action rotation. The Purdue Weed Science program has noticed that many producers would not use the chart if not properly instructed on how to use the chart. We emphasized instruction on how to use the chart at meetings this past winter. The following is an extension of this effort to explain the chart layout and how Purdue weed scientists are encouraging producers to use the chart when planning their weed management program.

### Mode of Action vs. Site of Action

The first explanation to end some confusion is the difference between “mode of action” and “site of action”. Sometimes the terms are thrown around and interchanged and can become confusing as to what is what.

- **Mode of action:** refers to the way in which the herbicide effects plant growth (visual symptoms on the plant) and eventual death at effective doses
- **Site of action:** refers to the specific enzyme site or pathway that the herbicide binds or inhibits to create the plant growth effects

In simplistic terms the sites of action are subsets of the broader modes of action. Several modes of action only have one site of action while others have two or three sites of action. To ultimately increase the number of chemicals available for use in a rotation, producers should focus on “Sites of Action” rather than “Modes of Action”. The Corn and Soybean Herbicide Chart was designed around the Sites of action and WSSA assigned Site of Action group.

**Corn and Soybean Herbicide Chart**

Repeated use of herbicides with the same site of action can result in the development of herbicide-resistant weed populations.

**By Mode of Action (effect on plant growth)**

This chart groups herbicides by their modes of action to assist you in selecting herbicides to maintain greater diversity in herbicide use and to rotate among herbicides with different sites of action to delay the development of herbicide resistance.

The Site of Action Group is a classification system developed by the Weed Science Society of America.

**By Premix**

This chart lists premix herbicides alphabetically by their trade names. You can identify the premix component herbicides and their respective sites of action groups. Refer to the Mode of Action chart on the left for more information.

**Mode of Action Legend:**

- 1 Light Growth Inhibitors
- 2 Acid Growth Inhibitors
- 3 Growth Regulators (auxin mimics)
- 4 Photo-synthesis Inhibitors
- 5 Nitrogen Metabolism
- 6 Protein Inhibitors
- 7 Membrane Disruptors
- 8 Seedling Root Growth Inhibitors
- 9 Seedling Shoot Growth Inhibitors
- 10 Growth Inhibitors
- 11 Growth Inhibitors
- 12 Growth Inhibitors
- 13 Growth Inhibitors
- 14 Growth Inhibitors
- 15 Growth Inhibitors
- 16 Growth Inhibitors
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- 99 Growth Inhibitors
- 100 Growth Inhibitors

The Corn and Soybean Herbicide Chart PDF can be downloaded by clicking on the image above or going to: [https://ag.purdue.edu/btny/weedscience/Documents/Herbicide\\_MOA\\_CornSoy\\_12\\_2012%5B1%5D.pdf](https://ag.purdue.edu/btny/weedscience/Documents/Herbicide_MOA_CornSoy_12_2012%5B1%5D.pdf)

# Corn and Soybean Herbicide Chart

April 18, 2013

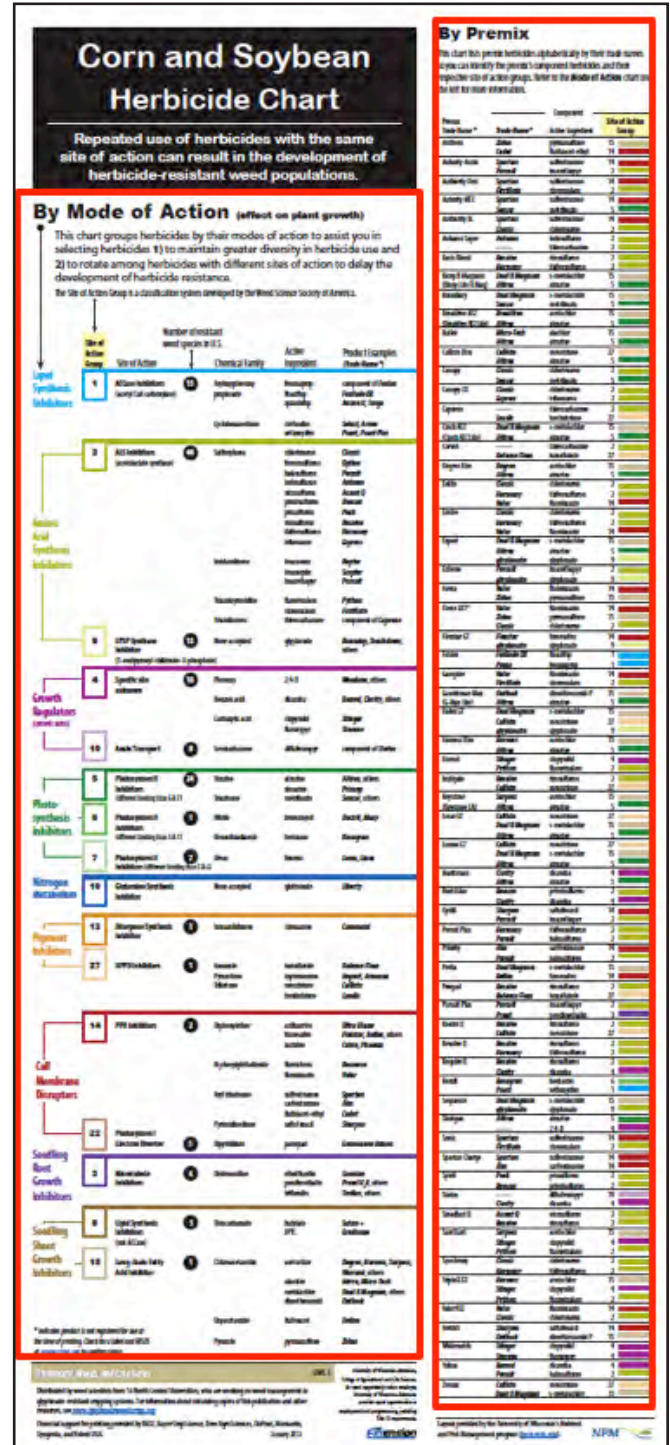
## Chart Layout

The chart actually contains two charts, "By Mode of Action" and "By Premix", which are linked by a color-coding system. The "By Mode of Action" chart would be the large chart under the large black header and the "By Premix" chart being the smaller chart on the far right.

### "By Mode of Action"

The "By Mode of Action" table is a grouping of active ingredients and products containing single active ingredients into chemical families, sites of action and lastly modes of action. The single ingredient products and active ingredients are listed individually on the right of the chart and progress in their groupings to the left. Each column of the chart from the left to the right is explained below:

- **Mode of Action:** As explained previously, this is the broad grouping of herbicides by their effect on plant growth. Within this chart the Modes of action are separated by brackets and different colors
- **Site of Action Group:** The site of action group is a numerical value that has been assigned to each site of action by the Weed Science Society of America. The site of action group numbering system was designed for quick and simplistic recognition rather than using the complicated scientific names that can be cumbersome and confusing for producers. A colored box that corresponds to the mode of action that each site of action belongs to encloses and represents each site of action group number. Modes of action with multiple sites of action have different shades of the mode of action color representing each site of action (i.e. Site of action groups 5, 6, and 7 are all Photosynthesis-inhibitors and are represented by three shades of green.)
- **Site of Action:** The site of action as explained above is the site or physiological pathway that the herbicide binds or inhibits. Again the sites of action are subsets of the mode of action and should be the focus of herbicide program rotations. Each site of action will have a site of action number as described above.
- **Number of resistant weed species in U.S.** The numbers encircled in black dots represent the number of weed species that are resistant to each herbicide site of action.
- **Chemical Family:** The grouping of herbicides within each site of action by their chemical structures.
- **Active Ingredient:** The accepted common chemical name of the actual component that is responsible for growth effects, injury, and death of susceptible plants. This will be listed on the front of every herbicide label on the front panel under active ingredients.
- **Product Examples (Trade Name®):** The marketed or trade name of products that only contain only one active ingredient that is listed to the immediate left.



The red boxes outline the two independent tables within the Corn and Soybean Herbicide Chart. The "By Mode of Action" chart is on the left and "By Premix" on the right.

### How to use the “By Mode of Action” Chart (Working from the right to left)

To find the details of the herbicide product “Permit” you would start by finding “Permit” in the Product Examples (Trade Names®) column. Then working back to the left column by column you would find the following:

Permit’s active ingredient is halosulfuron, which is part of the sulfonylurea chemical family that is part of the ALS Inhibitors (acetolactate synthase) site of action. The ALS inhibitors site of action has 44 resistant weed species in the U.S. and has been assigned the Site of Action group number 2. The mode of action of Permit is amino acid synthesis inhibitors.

Producers using this chart to outline the sites of action used in their herbicide program will focus on the Example products (Trade Names ®), Active Ingredient, and Site of Action Group columns.

### “By Premix” Chart

The problem with listing example single ingredient trade name products is that many products contain multiple active ingredients and are often referred to as premixes. The “By Premix” chart allows users to quickly look up the active ingredients and sites of action in a premix product and link them back to the “By Mode of Action” chart for more details. The premix products are listed alphabetically by their trade names in the far left column. As you move across to the right you will see the break down of each premix by single ingredient

trade name products, active ingredients, and site of action group numbers. Also on the far right is a colored bar that matches the color coding and shading of the mode of action and site of action in the “By Mode of Action” chart.

An example premix product would be Anthem that appears at the top of the chart. Anthem contains the trade name products Zidua and Cadet which contain the active ingredients pyroxasulfone and fluthiacet-ethyl, respectively. The two active ingredients belong to the site of action groups 15 and 14. A producer could obtain more information about these active ingredients by using the colors; light brown and dark red, to link back to the “By Mode of Action” chart. The user could also link back to the “By Mode of Action” chart with the site of action group numbers, active ingredients, and/or product examples (Trade Name®).

**By Mode of Action (affect on plant growth)**

This chart groups herbicides by their mode of action to assist you in selecting herbicides. To maintain greater diversity in herbicide on-crop it is recommended herbicides with different sites of action to delay the development of the weeds or resistance.

The Site of Action Groups classification system developed by the World Weed Society of America.

Site of Action Group	Mode of Action	Number of resistant weeds (in the U.S.)	Chemical Family	ALS Inhibitors	Other	Product Examples
1	Acetolactate Synthase Inhibitors	44	Sulfonylurea	Yes	No	Chlorimuron, fuazasulfuron, halosulfuron, imazosulfuron, nicosulfuron, primisulfuron, prosulfuron, rimsulfuron, thifensulfuron, tribenuron
2	Amino Acid Synthesis Inhibitors	0	Imidazolinone	No	Yes	imazamox, imazaquin, imazethapyr
3	Microtubule Disruptors	0	Triazolopyrimidine	No	Yes	flumetsulam, clorasulfam
4	Microtubule Disruptors	0	Triazolones	No	Yes	thiencarbazone
5	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
6	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
7	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
8	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
9	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
10	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
11	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
12	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
13	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
14	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
15	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
16	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
17	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
18	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
19	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
20	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
21	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
22	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
23	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
24	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
25	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
26	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
27	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
28	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
29	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
30	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
31	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
32	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
33	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
34	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
35	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
36	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
37	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
38	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
39	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
40	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
41	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
42	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
43	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl
44	Microtubule Disruptors	0	Other	No	Yes	florasulam, pyraflufen-ethyl



An example of how the “By Mode of Action” table is used to look up the trade name product Permit. The red arrows indicate the progression from Trade name to active ingredient, chemical family, site of action, site of action group, and mode of action.

# Corn and Soybean Herbicide Chart

April 18, 2013

## Outlining Herbicide Programs Using the Corn and Soybean Herbicide Chart

The message that Purdue Weed Science has stressed to Indiana producers is to sit down with their planned herbicide program for this year and write out the site of action group(s) for each product using the Corn and Soybean Herbicide Chart. We have even challenged producers to write out two cropping years of their herbicide program. After writing out the sites of action there are a number of things that a producer should look for in their planned herbicide program, including:

- The overall number of site of action groups that are being used in the planned herbicide program.
- The number of site of action groups that are effectively controlling the weeds that are present in the field. i.e. Group 2 (ALS Inhibitor) herbicides would not be considered a site of action that is effectively controlling an ALS resistant weed species.
- Any repetition or reliance on a single site of action in the herbicide program. The use of a site of action more than two times in a growing season would be considered overreliance on that site of action and places significant selection pressure on that site of action

An ideal herbicide program would maximize the number of effective site of action groups without using any site of action more than two times in a growing season.

### Example Herbicide Program Outlined

This program is for no-till soybean for control of an ALS and glyphosate resistant Palmer amaranth population. The table has the trade name products with their corresponding active ingredients and site of action groups.

Application Timing	Trade Name Product	Active Ingredient	Site of Action Group
Burndown	Gramoxone Inteon	paraquat	22
	Sencor	metribuzin	5
	Sonic	sulfentrazone cloransulam	14 2
Early Post	Prefix	fomesafen	14
		S-metolachlor	15
Late Post	Cobra	lactofen	14

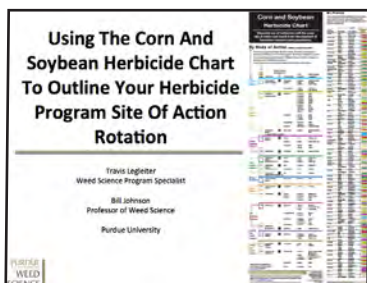
After outlining the site of action groups in the program you can see that this program contains a total of 5 site of action groups, four of which are effectively controlling the target weed (Group 2 herbicides are not effective on ALS resistant weed species). The other thing to notice is the repetitive use of group 14 herbicides, for a total of 3 times in one growing season. In this program a significant amount of selection pressure is being placed on the group 14 herbicides and an adjustment would be recommended such as the following.

Information listed here is based on research and outreach extension programming at Purdue University and elsewhere.

The use of trade names is for clarity and does not imply endorsement of a particular product, nor does exclusion imply non-approval.

Always consult the herbicide label for the most current and update precautions and restrictions. Copies, reproductions, or transcriptions of this document or its information must bear the statement:

"Produced and prepared by Purdue University Extension Weed Science" unless approval is given by the author.



Want more? Click on the graphic to see a aprox 25 min presentation of how to use the Corn and Soybean Herbicide Chart. You can also see the video by going to <http://www.youtube.com/watch?v=fBegM4XcJ4Y>.

Application Timing	Trade Name Product	Active Ingredient	Site of Action Group
Burndown	Gramoxone Inteon	paraquat	22
	Sencor	metribuzin	5
	Sonic	sulfentrazone	14
		cloransulam	2
Early Post	Prefix	fomesafen	14
		S-metolachlor	15
	Liberty	glufosinate	10
	Dual II	S-metolachlor	15
Late Post	Gobra	lactofen	14
	Liberty	glufosinate	10

The replacement of the early and late post applications with Liberty (Group 10) relieves the pressure on the group 14 herbicides. However, if we apply Liberty twice during the growing season we are putting selection pressure for glufosinate resistance. We would recommend caution in using a program like this in consecutive years because of the increased selection pressure. It is encouraged for producers to use this chart to outline two years of their herbicide program to prevent recurring selection pressure over multiple years.

This is only one example of how to alleviate the selection pressure in this program. Many other options are available such as replacing the Sonic product with a non-group 14 herbicide with effective residual activity on ALS and glyphosate resistant Palmer amaranth and using one post pass of Liberty and one post pass of a group 14 (PPO inhibitor) herbicide.

In conclusion, use of this chart when planning weed management programs will be helpful in determining if you are over using specific sites of action and selecting for additional herbicide-resistant weed problems.

