

-Purdue Cooperative Extension Service

April 26, 2013 - Issue 4-

In This Issue —

Insects, Mites, and Nematodes

- Managing Western Corn Rootworm Resistance to Bt on the Fringe
- Black Cutworm Adult Pheromone Trap Report

Weeds

• How to Effectively Use the Corn and Soybean Herbicide Chart

Agronomy Tips

 Plentiful Winter and Spring Precipitation - Nitrogen Carryover Unlikely for Most of Indiana

Weather Update

- Indiana's Weather Forecast
- Moisture and Temperature Accumulations

Insects, Mites, And Nematodes —

Managing Western Corn Rootworm Resistance to Bt on the Fringe - (Christian Krupke)

- Resistance to some Bt corn hybrids has been detected in Iowa and elsewhere.
- Growers in Indiana may be at reduced risk due to different cropping systems and low rootworm populations in recent years.
- The current situation and best management practices developed by corn entomologists are summarized in the linked document.

The first Bt toxin for rootworm control, Cry3Bb1, was sold in Yieldgard Rootworm hybrids in 2003, then combined with corn borer Bt traits and/or herbicide tolerance genes in YieldGard Plus, VT Triple, and Genuity VT Triple Pro. By 2010, Cry3Bb1 was part of a multi-trait pyramid in SmartStax (with Cry34/35Ab1) for rootworm control. The approval of pyramids led to a reduction in refuge from 20% to 5%. EPA also approved refuges in-the-bag for some traits. (To read more....click)



Results from severe rootworm feeding



http://extension.entm.purdue.edu/pestcrop/index.html

Black Cutworm Adult Pheromone Trap Report Week 1 = 4/11/13 - 4/17/13 Week 2 = 4/18/13 - 4/24/13								
		BCW Trapped					BCW Trapped	
County	Cooperator	Wk 1	Wk 2	County	Cooperator	Wk 1	Wk 2	
Adams	Kaminsky/New Era Ag	5	5	Knox	Bower/Ceres Solutions/Vincennes		0	
Adams	Roe/Mercer Landmark	7	9	Knox	Hoke/SWPAC	3	1	
Allen	Anderson/Syngenta Seed	0	3	Lake	Kleine/Kleine Farms	5	31*	
Allen	Gynn/Southwind Farms	1	14*	Lake	Moyer/Moyer Seed Sales - Shelby	1	2	
Benton	Babcock/Ceres Solutions	0	2	Lake	Moyer/Moyer Seed Sales - Schneider	4	5	
Boone	Campbell/Beck's Hybrids	8	8	LaPorte	Barry/Kingsbury Elevator	1	0	
Boone	Carrell/Lamb Farms Agronomy	2	0	LaPorte	Rocke/Agri-Management Solutions	2	3	
Clay	Bower/Ceres Solutions - Brazil	0	0	Miami	Early/Pioneer	4	1	
Clay	Bower/Ceres Solutions - Clay City	0	0	Newton	Moyer/Moyer Seed Sales	3	1	
Clinton	Foster/Purdue Entomology		6	Porter	Leuck/PPAC	4	0	
DeKalb	Hoffman/ATA Solutions	0	0	Putnam	Nicholson/Nicholson Consulting	2	2	
Dubois	Eck/CES	4		Randolph	Boyer/DPAC	5	8	
Elkhart	Kaufman/Crop Tech	4	1	Rush	Schelle/Falmouth Farm Supply	0	0	
Fayette	Schette/Falmouth Farm Supply	0	0	Starke	Wickert/Wickert Agronomy Services	1	0	
Fountain	Mroczkiewicz/Syngenta	2	4	Sullivan	Bower/Ceres Solutions - New Lebanon	0	2	
Fulton	Jenkins/N. Central Coop - Rochester	2	5	Sullivan	Bower/Ceres Solutions - Sullivan W	10*	4	
Fulton	Jenkins/N. Central Coop - Kewanna	5	1	Sullivan	Bower/Ceres Solutions - Sullivan E	2	0	
Hamilton	Campbell/Beck's Hybrids	5	2	Sullivan	Bower/Ceres Solutions - Farmersburg	3	0	
Hendricks	Nicholson/Nicholson Consulting	14	31*	Tippecanoe	Bower/Ceres Solutions	8	14*	
Henry	Schelle/Falmouth Farm Supply	0	0	Tippecanoe	Nagel/Ceres Solutions	41*	23*	
Jasper	Overstreet/Purdue CES	4	0	Tippecanoe	Obermeyer/Purdue Entomology	1	4	
Jasper	Ritter/Brodbeck Seeds	0	0	Tippecanoe	Westerfeld/Monsanto	0	0	
Jay	Shrack/RanDel AgriServices	3	7	White	Reynolds	0	11*	
Jennings	Bauerle/SEPAC	0	0	Whitley	Walker/NEPAC	0	12	
Knox	Bower/Ceres Solutions/Frichton	0	2					

Weeds

How to Effectively Use the Corn and Soybean Herbicide Chart – (*Travis Legleiter and Bill Johnson*) –

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.

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 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 Photosynthesisinhibitors 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.

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

April 26, 2013 • Page 4

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 divenity 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 Wied Science Society of America.

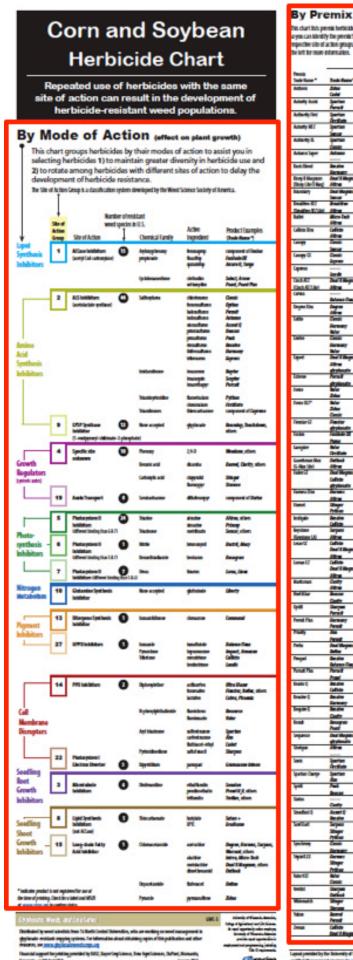
		ALC 1	ber of and	h Lunt			
3	in of Cian	WOOD	ispecies in	2.01	Active	Poductioumpion	-
* •	-	Sile of Action	+	Chemical Family	ingredient	(Prode Rame *)	-
Lipid Synthesis Inhibitors	1	ACCentrichibitions (postyl Call catherylaw)	8	Anterphysics projector	hanger hatter	corpored of Facilies Facilitatio 22 Accaro 8, Tange	d al ab a al al a a a
interestors.							0
				Optimizations	orthogen withoughn	Select, Arrow Point, Point Rev	0
	2	AS labition	٥	Suffragence	citetanes bomulanes brinafanes brinafanes providenes providenes brinafanes brinafanes brinafanes	Candi Golda Arand Arand Arand Basar Rand Basar Rand Basar Rand Basar Rand Basar Rand Basar Rand Rand Rand Rand Rand Rand Rand Rand	6
	-	(antoiaciale synthese)	•		boundance	Option	D.
1.1					advallant.	Arbane	
					stration .	Accest Q Descar	
Amino					providents.	Peet	L.
Acid					Manufactor 1	Armor	-
Synthesis					of entering states	Segregation of the second s	-
Inhibitors				Industries	The state	Auster	10
					marriage	Pond	-
				Mankeyteridee	Americalism domination	Pythee	-
				Vanleyer	downsiam New advance	Painat Aystaan Rectificato composent of Caprano Reconting, Dachatowa,	
		CT below	0	Non accepted	-	Bandra Banklam	B
	-	1757 Synthese Induktor G-ensignaryi-cikinak			1000	atten.	ъ
				**			-
Growth	•	Specific site unknown	0	Press and	240	Balan, shen	-
Growth				Search with	dante.	Rennel, Garity, stiers.	4
Regulators (print and)				Carbonylic with	dayaki karager	Shipe Zanan	
- I - E			_				The second
	19	Auto Transport	0	Sectore	dial-supp	composed of Dates	-
		Balancian I.	0	20.00	da da	Altra, dise	-
	1	Photosystem II Inhibition Offeren Tanlay, Itan (14)	٥	1000	distin titulin mitbuli	Allowing starts	÷
Photo-				Hadeone	arthus		
	•	Photosystem II Indultion Utherest Studies that 144	0	No.	bein any d	Bactril, Harry	14
Inhibitors	=			Institution	bestans	Imagen	-
	7	Platarytics I Inhibitor (fired ted	0	Circuit I	barra .	Corne, Citrae	
	-		ng Alis (A				
Nitrogen Metabolism	10	Calamiter Systilenis Intellige		Non-accepted	glatesiade	identy .	T
	13	Marganan Synthesis	0	hautiking	downer	Comment	-
	_	tableter .	•				-
	_						
Pigment Inhibitors			~				_
	27	anti babban	0	hmatik Pysatian		Interco Fina Imped, Armana	h
	27	870 bibbban	0	hmatië Pysatiae Matao		Adams Figg Angent, Amazan Calibris	1
		WTO in this or	-	hantè Pyunian Malan	teachd is teparatear an attar tealaittear	Adams Figg Report, Amoran Califica Londo	1 1 1 1
		179 bibblen	0	hmatik Pyunian Idatan Djanyiclar		Londit	
			-	hmazik Iyuntar Italaa Igangidar		Londit	
			-	hmatik Ppuntar Histor Djangkilor	atiliaries branalie jatales	Bha Baar Raste, Jola, shen Cales, Pasada	
			-	hmanis Pynotase Idetase Dytosykther Kylonyktheleste		Londit	
			-	haazb Pynnise Dideos Djargither Kylengitheleste Ayl Yschwe	attaries broute lates brittes brittes	inde Dis Daar Reete, Ade, else Gde, Romis Beaux Ree	
Land Carl			-	hmashi hmashi Yantaa Bijangisher Kylengishalashi Agʻinahaan	atkorie beruie lattie lattie lattice lattice atheteer atheteer	inde Dis Daar Reete, Ade, else Gde, Romis Beaux Ree	a la
Call Nombrane Disspires	••		-	haasib Pyanitee Bildese Bijkeykilee Bijkeykileksis Aylitekses Tyleckeekse	atiliaries branalie jatales	Bha Baar Raste, Jola, shen Cales, Pasada	
Gall Biompters			-	haasib Papasian Distane Distane Sylanyishakasin Ayl Vashaw Pyinikesker Syntikes	atkorie beruie lattie lattie lattice lattice atheteer atheteer	inde Dis Daar Reete, Ade, else Gde, Romis Beaux Ree	i si
Gal Kambrane Disnyters	22	PRI skilden	0	Bylonyktor Bylonykthalasto Ayl Istotaar Fynaidenker Byrtillen	atharin broute latin keisin keisan afritaan afritaan afritaan afritaan afritaan afritaan afritaan afritaan afritaan afritaan	Londi Dira Dicar Anato, Anla, etca Anato, Anato Dirar Nar Sartos Ana Cale Daryon Canacana bitwa	a la la al al al al al al al al al a
Call Membrane Disruptors	••	PRI skilden	0	Bylogister Kylonykitulosto Aylituttuse Fytoskoskos	atharin broute latin keisin keisan afritaan afritaan afritaan afritaan afritaan afritaan afritaan afritaan afritaan afritaan	Londi Dira Dicar Anato, Anla, etca Anato, Anato Dirar Nar Sartos Ana Cale Daryon Canacana bitwa	
Gal Kambrane Disnyters	22	PRI skilden	0	Bylonyktor Bylonykthalasto Ayl Istotaar Fynaidenker Byrtillen	atlaris books latie bothe bothe bothe atlature atlature bothet bothet bothet	inde Dis Daar Reete, Ade, else Gde, Romis Beaux Ree	이 44 41 41 41 41 41 41 41 41 41 41 41 41
Call Membrane Disnapters Seetling Root	22	PRi lakalitan Paris piana I Dari na Staniar Ricat daria Jakalian	0	Bylonyklur Bylonyklukski Aylitukser Pyteikerker Byteiker Baltrather	atharin broute latin keisin keisan afritaan afritaan afritaan afritaan afritaan afritaan afritaan afritaan afritaan afritaan	Londi Bito Elsar Dester, Anler, elsen Calter, Panala Basera Rain Sartes Canacame Interne Commune Interne Santas Anali (f. alam Anali (f. alam	فافاط فاط فاط فاط فاط كاكا كاكا فاط فاحا واسط فاعلما طمعا واط عا ماط كلاحا
Call Hembrane Disruptors Root Growth Inhibitors Seedling	22	Pito bakalitan Pitota patawa Dantas Dawlaw Eli ani darla bakalitan Dajat Spetitanis	0	Bylonyktor Bylonykthalasto Ayl Istotaar Fynaidenker Byrtillen	atharin broute latin keisin keisan afritaan afritaan afritaan afritaan afritaan afritaan afritaan afritaan afritaan afritaan	Londi Dira Dicar Anato, Anla, etca Anato, Anato Dirar Nar Sartos Ana Cale Daryon Canacana bitwa	해 비 비 세 세 비 해 시 비 해 비 비 위 기 기 기
Call Nombrate Disruptors Seedling Root Growth Inhibitors Seedling Shott	14	Pito lakkitan Piatogolani 1 Detras Senter Ekol dala Sekitian Sekitian Sekitian	0	Bylonyklur Bylonyklukski Aylitukser Pyteikerker Byteiker Baltrather	aflaris boule latis boiles bolas afeitas afeitas bolastas	Londi Bito Elsar Dester, Anler, elsen Calter, Panala Basera Rain Sartes Canacame Interne Commune Interne Santas Anali (f. alam Anali (f. alam	7
Cal Mombrane Disruptors Boot Growth Soodling Shoot Growth	14 22 3	PHO tableton Photogeton 1 Decision Streeton Riccatedolor Relative Statistics Upd Spectrack Weblitum (or Allory) Lang-dale Felty	0	Bylonyklur Bylonyklukski Aylitukser Pyteikerker Byteiker Baltrather	aflaris boule latis boiles bolas afeitas afeitas bolastas	Lands Bits Blaar Factor, Anda, etca Bacaro Bar Bar Sortes An Camaro Ideas Santos Andel J. dan Indea, etca Santos Santos Santos Santos Santos Santos Santos Santos	2
Call Nombrate Disruptors Seedling Root Growth Inhibitors Seedling Shott	14 22 3	Pito lakkitan Piatogolani 1 Detras Senter Ekol dala Sekitian Sekitian Sekitian	0 0 0 0 0	Dijangkiber Kylenykibaksio Ayl'Indese Pyteskeniker Digitalian Distraction	atharin hondin kalin kanaan kalina kanisan tahanaan tahan	Lands Dis Blaar Factor, Andar, etca Bacaro Nor Sprite An Call Consume blaar Santor Andel J, dann India, etcan Santor Sant	7
Cal Mombrane Disruptors Boot Growth Soodling Shoot Growth	14 22 3	PHO tableton Photogeton 1 Decision Streeton Riccatedolor Relative Statistics Upd Spectrack Weblitum (or Allory) Lang-dale Felty	0 0 0 0 0	Dijangkiber Kylenykibaksio Ayl'Indese Pyteskeniker Digitalian Distraction	charles honde honde honde honde historie abstance abstance abstance abstance abstance abstance abstance abstance abstance page default page page default page page default page page default page page default page page default page page default page default page default page default page default page default page default page default page default page default page default page default page default page default page default page default page default page default default page default d	Lands Bits Dicar Factor, John, etc. Galar, Facada Galar Sortes Sartes Sartes Camazaro Johan Sartes S	a la la
Cal Mombrane Disruptors Boot Growth Soodling Shoot Growth	14 22 3	PHO tableton Photogeton 1 Decision Streeton Riccatedolor Relative Statistics Upd Spectrack Weblitum (or Allory) Lang-dale Felty	0 0 0 0 0	Bijkespielser Regiserspielsaksakse Angl Vischnese Pyrinskinerkiere Bistranskiere Distansakse Distansakse	chiofe broke killer killer ubriter obstane obstane obstane obstane obstane obstane obstane obstane propi difetti propi difetti propi obstane propi difetti propi obstane propi difetti propi obstane propi difetti propi difetti propi difetti propi difetti propi difetti propi difetti propi difetti propi difetti propi difetti propi difetti propi difetti propi difetti propi difetti di difetti di di di di di di di di di di di di di	Landi Bits Dicar Factor, John, etc. Color, Facal Barrow Sortin Calor Calor Calor Calor Samo Calor Calo	el al al al
Call Nombrate Disruptors Seedling Root Growth Inhibitors Shoot Growth Inhibitors	14 22 3 15	Pito tabilitan Padagatan I Debagitan I Debagitan Debagita Sabilitan Sabilitan Sabilitan Sabilitan Sabilitan Sabilitan Sabilitan Sabilitan Sabilitan Sabilitan	0 0 0 0 0	Bijangkilar Bijangkilakska Agʻlischara Pyrniskorska Biptilan Bistonska Directorski Directorski	chinis broke kites kites theises ubites obtines obtines obtines obtines obtines thise definit page definit page definit still the definit still the definit page definit still the definit the d	indi Bits Biar Facts, Anta, ston Cate, Frank Bir Sortes Cate Cate Cate Cate Cate Cate Cate Cate	a a a a
Call Nombrane Disruptors Disruptors Root Growth Inhibitors Seedling Sheet Growth Inhibitors	14 22 3	Pilologidaes I Dartae Stantor Electron Stantor Electron Stantor Electron Stantor Sold Spectron Sold Spectron Sold Spectron Sold Spectron Sold Spectron Sold Spectron Sold Spectron Sold Spectron Spectron Stanton Spectron Spe	0 0 0 0 0	Bijkespielser Regiserspielsaksakse Angl Vischnese Pyrinskinerkiere Bistranskiere Distansakse Distansakse	chiofe broke killer killer ubriter obstane obstane obstane obstane obstane obstane obstane obstane propi difetti propi difetti propi obstane propi difetti propi obstane propi difetti propi obstane propi difetti propi difetti propi difetti propi difetti propi difetti propi difetti propi difetti propi difetti propi difetti propi difetti propi difetti propi difetti propi difetti di difetti di di di di di di di di di di di di di	Landi Bits Dicar Factor, John, etc. Color, Facal Barara Bar Sertie Calor Sertie Calor Sertie Calor Sertie Calor Sertie	
Call Nombrane Disruptors Disruptors Inhibitors Seadling Sheet Growth Inhibitors Seadling Sheet Growth Inhibitors	14 22 3 15	Pilologidami I Datas Stantar Eksten Stantar Eksten Stantar Ekster Sold Sector Sold Sector	0 0 0 0 0	Bijangkilar Bijangkilakska Agʻlischara Pyrniskorska Biptilan Bistonska Directorski Directorski	atharin Iatharin Iathari Kanitak Kanit	indi Brolliar Rate, Anle, etc. Socie Nor Sprite An Color Sause Common blow Common blow Common blow Common blow Common blow Common blow Sauje Antif (don India, etc.) Sauje Sa	a a a a
Call Nembrane Disruptors Seedling Boot Growth Inhibitors Seedling Sheet Growth Inhibitors	14 22 3 15 statistics attentions	PRO balkbillion Photosystems1 Dectros Disorder Elizat declar balkbillion Split Spettersh balkbillion (ed Alizer) Long-dash Edity Add balkbillion meller and dec.	0	Björspielser Ryterspielskatter Arf Techner Dynatikersker Bystellan Detrausker Discolaratio Discolaratio Pysociantio	starin book book book book book book book boo	indi Bits Biar Facts, Anta, ston Cate, Frank Bir Sortes Cate Cate Cate Cate Cate Cate Cate Cate	el el el el el el el
Call Nembrane Disruptors Seedling Boot Growth Inhibitors Seedling Sheet Growth Inhibitors	14 22 3 15 statistics attentions	PRO balkbillion Photosystems1 Dectros Disorder Elizat declar balkbillion Split Spettersh balkbillion (ed Alizer) Long-dash Edity Add balkbillion meller and dec.	0	Björspielser Ryterspielskatter Arf Techner Dynatikersker Bystellan Detrausker Discolaratio Discolaratio Pysociantio	starin book book book book book book book boo	indi Bits Biar Facts, Anla, ston Calar, Facati Bar Sortes Enter Calif Ca	
Call Nembrane Disruptors Seedling Root Growth Inhibitors Seedling Shoot Growth Inhibitors	14 22 3 4 4 5 4 5 4 5 4 5 4 5 4 5 5 5 5 5 5 5	Pito sublition Pitotogoloni I Decine Sherine Esculates Esculates Def Porthers behavion pet Allory Long dub Telly Add babbler miller and telef 2015 telef 2	0	Bijkespilder Bijdespildeksele Anf Vachause Pyteskine Bistranike Distantion Distantion Distantion Distantion Distantion Synach	atharin handin hatio hation hation abbiest histor history thiese dy history thiese dy proper thiese dy proper thiese states history distinct states proper history distinct states history distinct history di his	indi Bradicar Gente, Ander, store Color, Frank Ber Sorten Sorten Color Color, Frank Ber Sorten Sorten Color Color Sorten Color Sorten Color Sorten Color Sorten Sor	الداما ماما ما يدايرا يرا
Call Nembrane Disruptors Seedling Root Growth Inhibitors Seedling Shoot Growth Inhibitors		Pito sublition Pitotogoloni I Decine Sherine Esculates Esculates Def Porthers behavion pet Allory Long dub Telly Add babbler miller and telef 2015 telef 2	0	Bylonyklur Eylenyklukusio Ayl Yackow Pytecklus Baltnasko Dataalas Dataalas Dataalas Dataalas Dataalas Dataalas Dataalas Dataalas	atharin handin hatio hation hation abbiest histor history thiese dy history thiese dy proper thiese dy proper thiese states history distinct states proper history distinct states history distinct history di his	indi Broker Antre, Anle, eine Antre, Anle, eine Antre Antre Sprise Antre Color Antre	visia de la la de d

		Casport -	-
Penda Toda Kama * Anthens	bain feme"	Atte burdet	Steel Artise Group
Adhen	Bade Rome" Solar Cadat	presentine .	8
Antelly hold	Casher Soundham	Schuck-obyl	8
	Annat	Butfley	2
Adarby Test	Contract of	sufficiences Constalient	
Address MC	Spectrum.	albeirane	1 N N N N N N N N N N N N N N N N N N N
Adarty 1.	Sporter Openie	addate	*
Adam Sper	Genik	Chief manual	-
	Antone	introducer Descalator	;
Rest liest	And in	teaters.	2
Stop I Magnam Stop Live I Mag Standary	Desi 1 Hageure	1-origination	8
Daig Las 1 Mag	Allen Des Regnes	dista in	5
	later	addam.	
India II	South a	and an	
Canadiana B.C. Links	Altre Altre fait Altre Cation Altre Cassie	deciter .	5
Callen Die	Altre Caller	dative .	5 27 5 2
	Altre	date	3
Campo	Canal Canal	distants.	
Campy Cl.	Gentit	chief manu	3
Gene	apres	(Becaliume	2
	José Likepun	Install Name	
Code ATZ	Aller	distant.	
Cares (Criss)	Allin Belance Reas Degree Alline Classic	tirouture	2
Degree Tim	Determination of the second	autochir	8
	Allen	discine .	
16.0	Server .	Clining and States	;===
Latio	Bernuny Neler Gersk	Brokenth	-
	Second y	Disafes	2
Terri	Remay Nor Sol 1 Hopen Altre	Burnimuchts	
Land	Altre	disting.	5
Line	dypinate for	distants	1
	stateste	distant.	
fees	Aller John	Summer Street	1
fore th?"		Burning III	
	Select Canada	permanalized	5
Firefar C	Anter	Incade	8
Loin	deployed a	distants	
	Ame	busers.	
Gangtier	Nation Carolitation	Summing the	1
Guntane Mar Guiller Uni Talle UT	Onthest	davbrunki?	5
C-Res Land	Aller Bagers	a contrate like	-
	Gille	maintee	7
James Tex	Permit	ario Nr	-
	Aller	date	
Ramat	Altra Singer Aylan Bauto	chayraid Bararbaian	;
Indigate	An size	trailer.	2
inige lectore	Sarper	tealtas anotes anticitas	2
lentigato Septimo Science 20	Sarper	ticulture analitee anticiter disting	
indydr Brytine Bretine (8 Lour 12	Analos Calitita Sorper Altina Calitita Desl'i Hogeum	teraños antitez antitez antitez antitez > estador	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
Regime Regime UK Lour V	Calific Surgers Altra Calific Deal I Magnet	date	
Instigate Registere Registere VII Learn VI	Calific Surgers Altra Calific Deal I Magnet	tenites antitias antitias antitias nectas - originas metions - originas - originas - originas - originas	2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
Replace UP Land C? Land C?	Californ Sorgans Altern Deal Lillageans Altern Californ Deal Lillageans Altern	date	2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
Beyland Betring (B Long (2 Long (2 Referen	Calific Surgers Altra Calific Deal I Magnet	date	2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
Replace UP Land C? Land C?	Californ Sorgans Altern Deal Lillageans Altern Californ Deal Lillageans Altern	disalar manoidissa a caritalachtar disalar disantar	
Beyland Betring (B Long (2 Long (2 Referen	Californ Sorgans Altern Deal Lillageans Altern Californ Deal Lillageans Altern	dista ancidere i orisicilar diarda diarda diarda diarda diarda	
Bestan Bestan U Land 12 Kottan Rottine Quil	Californ Sorgans Altern Deal Lillageans Altern Californ Deal Lillageans Altern	disalar manoidissa a caritalachtar disalar disantar	
Sectors (2) Long (2) Long (2) Keltonen Ratt (2) Optil Densi Pan	Californ Sorgans Altern Deal Lillageans Altern Californ Deal Lillageans Altern	dista ancidere i orisicilar diarda diarda diarda diarda diarda	
Boston (B Boston (B Land C Land C Bost (Land C Bost (Land Quill Press) Pass Press) Pass	Californ Sorgans Altern Deal Lillageans Altern Californ Deal Lillageans Altern	dista ancidere i orisicilar diarda diarda diarda diarda diarda	
Regions (2) Regions (2) Lower (2) Regions	Californ Sorgans Altern Deal Lillageans Altern Californ Deal Lillageans Altern	distin matricus i antiaitin distin distin phinisiken distin phinisiken distin d	
Boston (B Boston (B Land C Land C Bost (Land C Bost (Land Quill Press) Pass Press) Pass	Californ Sorgans Altern Californ Deal Tillageann Altern Deal Tillageann Altern	dista ancidere i orisicilar diarda diarda diarda diarda diarda	
Region (1) Sectors (1) Lower (2) Sectors (Calton Sarpent Altra Calton Ded Silkepues Altra Calton Ded Silkepues Altra Calton Ded Silkepues Altra Sector Remary Remary Remary Remary Remary Remary Remary Remary Remary Remary Remark Remar	distin matricus i antiaitin distin distin phinisiken distin phinisiken distin d	
Boylano <u>Rodeine (U</u> Laure 12 Laure 12 Rodeine Rodeine Rodeine Rodeine Rodeine Rodeine Rodeine Rodeine Rodeine Rodeine Rodeine Rodeine Rodeine (U)	(dite Surget Alba (dite) Del Hopen Alba Calto Alba Calto Alba Calto Alba Surget	distin matricus i antiaitin distin distin phinisiken distin phinisiken distin d	
Region (1) Sectors (1) Lower (2) Sectors ((dia (dia) (distin matricus i antiaitin distin distin phinisiken distin phinisiken distin d	2 2 2 2 2 2 2 2 2 2 2 2 2 2
Boylano <u>Rodeine (U</u> Laure 12 Laure 12 Rodeine Rodeine Rodeine Rodeine Rodeine Rodeine Rodeine Rodeine Rodeine Rodeine Rodeine Rodeine Rodeine (U)	(dite Surget Alba (dite) Del Hopen Alba Calto Alba Calto Alba Calto Alba Surget	distin matricus i antiaitin distin distin phinisiken distin phinisiken distin d	2 5 5 5 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7
kejanu Redav 28 Juart Lansi 17 Katinan Rattis Pal Pal Pal Pal Pal Pal Pal Pal Pal	(dia (dia) (distin matricus i antiaitin distin distin phinisiken distin phinisiken distin d	2 5 5 5 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7
kejatau Rentara 28 Juan 17 Katinan Ratitur Ratitur Pela Pela Pela Rent Pia Rent Pia Rent Pia	Latin Latin Serper Altra Altra Altra Altra Calibio And Ellopese Altra Calibio Cali	Distr societas societas societas societas dentes de	22 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
legister Redakt 20 Lensel 2 Lensel 2 Kettiven Reditive Reditive Pred Plan Pred Plan Pred Plan Pred Plan Reditive Rediti	(alta (alta Serper Alta Caldo Serper Serper Serper Alta Caldo And Singers Alta Caldo And Singers Alta Caldo Cald	distan section section density dens	
legister Redakt 20 Lensel 2 Lensel 2 Kettiven Reditive Reditive Pred Plan Pred Plan Pred Plan Pred Plan Reditive Rediti	Latin Latin Serper Altra Altra Altra Altra Calibio And Ellopese Altra Calibio Cali	Distr societas societas societas societas dentes de	
legister Redace 28 Lensel 2 Lensel 2 Kettione Redition Redition Pred Plan Pred Plan Pred Plan Pred Plan Reditio	Latin Latin Serper Altan Altan Altan Altan Altan Altan Calify Calify Altan Calify C	niste souties souties souties is souties tiste duste duste duste vidend	
legister Redaktive Lansel 2 Lansel 2 Kettive Redisker Redisker Prod Pite Prod Pite Prod Pite Prod Pite Redisker	Lalia Lalia Alba Sorper Alba Sorper Alba Sorper Alba Sorper Alba Sorper Alba Sorper Alba Sorper Berner Alba Sorper Berner	rible anables anables anables factor durate durate anables rible anables anabl	
legister Redace 28 Lensel 2 Lensel 2 Kettione Redition Redition Pred Plan Pred Plan Pred Plan Pred Plan Reditio	Lalia Lalia Alba Sorper Alba Sorper Alba Sorper Alba Sorper Alba Sorper Alba Sorper Alba Sorper Berner Alba Sorper Berner	ibit sanista sanista S	
legister Redaktive Lansel 2 Lansel 2 Kettive Redisker Redisker Prod Pite Prod Pite Prod Pite Prod Pite Redisker	Lating Lating Albag Serpen Albag Devices Albag Calify Aust Stappen Albag Calify Aust Stappen Albag Bernen Termen Person Regen	ribit soubter soubter soubter fision dues	
legistus Restaur 20 Lanus 17 Restaurs Restaurs Restaurs Parts Parts Parts Parts Restaurs Rest	Lalia Lalia Alba Sorper Alba Sorper Alba Sorper Alba Sorper Alba Sorper Alba Sorper Alba Sorper Berner Alba Sorper Berner	ibit sanista sanista S	
keptaw 20 Redaw 20 Lansel 2 Redown Redown Redown Person Person Person Person Person Person Redown Re	Lalita Lalita Alba Serper Alba Serper Alba	ribit soubter soubter soubter fision dues	
keptaw 20 Redaw 20 Lanes 2 Ketawa Redawa Redawa Pres Pres Pres Pres Redawa Regels Real Salar Salar Salar Salar Salar Salar Salar Salar Salar	Latin Latin Area Area Area Area Area Area Area Area	ribit soubter soubter soubter fision dues	
keptaw 20 Redaw 20 Lansel 2 Redown Redown Redown Person Person Person Person Person Person Redown Re	Jalla Jaha Araka A	ibir anabar anabar anabar abada duala duala duala dualay history histo	
keptaw 20 Redaw 20 Lanes 2 Ketawa Redawa Redawa Pres Pres Pres Pres Redawa Regels Real Salar Salar Salar Salar Salar Salar Salar Salar Salar	Latin Latin Area Area Area Area Area Area Area Area	ibir anabar anabar anabar abada duala duala duala dualay history histo	
keydaw 20 Redaw 20 Lansel 2 Kedraw Redaws Redaw Pred Pan Pred Pan Pred Pan Pred Pan Pred Pan Redaw 2 Redaw 2 Redaw 2 Redaw 2 Redaw Series 2 Series	Jalla Jaha Araka A	ibir anabar anabar anabar abada duala duala duala dualay history histo	
kejatau Redata 28 Lanat 2 Lanat 2 Katiwa Rettier Pela Pela Pela Pela Pela Pela Pela Rettier Pela Pela Pela Rettier Ret	Jalla Jaha Aras Aras Aras Aras Aras Aras Aras Ara	ibir santhu sant	
kejatar Redav 20 Lana 17 Ketana Ketana Refar Pal Pal Pal Pal Pal Refar R	jalia jalia Alba Alba Alba Alba Alba Alba Alba Alb	ibir santhu sant	
kejatau Redata 28 Lanat 2 Lanat 2 Katiwa Rettier Pela Pela Pela Pela Pela Pela Pela Rettier Pela Pela Pela Rettier Ret	jalita jalita Alta Sarpen Alta Sarpen Alta Sarpen Alta Galth	ibili sanibar sanibar sanibar sanibar sanibar dada dada dada ukheda Ladiqu ukheda Ladiqu ukheda sanibar sanibar sanibar sanibar sanibar sanibar tasala	
kejatat Redaka (2) Lansa (2) Katiwa Ratika Red Ra Pada (2) Ratika	Jalia Jaka Sarpan Acato Sarpan Acato Acato Acato Calify Calify C	ibile souther souther souther souther souther is souther is souther and the souther of the souther sou	
kejatat Redaka 28 Janet Janet Retinen Retinen Pela Pela Pela Retine Reti	jalla jalla Alba Alba Sarpen Alba Alba Alba Alba Calb Alba Calb Alba Alba Alba Alba Alba Alba Alba A	ibile souther souther souther souther souther is souther is souther and the souther of the souther sou	
kejatat Redaka (2) Lansa (2) Katiwa Ratika Red Ra Pada (2) Ratika	jalita jalita Afar Afar Afar Afar Afar Afar Afar Afa	ibir saktar saktar saktar i sakisir dast dast dast dast dast situti situti situti saktar sakt	
kejatat Redaka 28 Janet Janet Retinen Retinen Pela Pela Pela Retine Reti	jalita jaripa Alba Alba Alba Alba Alba Alba Alba Alb	ibir saktar saktar saktar i sakisir dast dast dast dast dast sibir	
kejatau Redata 28 Lanas 27 Katiwas Ratikas Ratikas Ratikas Pada Pada Pada Ratik	Jalla Jahr Alexa A	ibar sandhar sandhar sandhar sandhar sandhar dura d dura d anda adada ad	
kejatau Redatar 28 Lanes 27 Katiwas Katiwas Katiwas Reditor Prod Pha Prod Pha Prod Pha Prod Pha Prod Pha Prod Pha Reditor Social Status Social Status	jalla jalla Sarpan Alba Alba Sarpan Alba Alba Alba Alba Alba Alba Alba Alba	ibir saktar saktar saktar i sakisir dast dast dast dast dast sibir	
kejatau Redata 28 Lanas 27 Katiwas Ratikas Ratikas Ratikas Pada Pada Pada Ratik	jalita jarpan Alba Alba Alba Alba Alba Alba Alba Alba	ibar sandhar sandhar sandhar sandhar sandhar dura d dura d sanda sandhar sandh	
kejatau Redatar 28 Lanes 27 Katiwas Katiwas Katiwas Reditor Prod Pha Prod Pha Prod Pha Prod Pha Prod Pha Prod Pha Reditor Social Status Social Status	Jallas Jahra Jarpan Alexa Jarpan Alexa Jarpan Alexa	ibar sandhar sandhar sandhar sandhar sandhar dura d dura d sanda sandhar sandh	
kejatar Redaka 28 Janet Janet Reditar Reditar Reditar Redit	jalita jalita Afar Afar Afar Afar Afar Afar Afar Afa	ibir sakiso sakiso sakiso sakiso i sakisir dask dask dask dask dask sakiso saki	
kejatar Redaka 28 Janet Janet Reditar Reditar Reditar Redit	jalita jarpan Alba Alba Alba Alba Alba Alba Alba Alba	ibir sakiso sakiso sakiso sakiso i sakisir dask dask dask dask dask sakiso saki	

By Premix

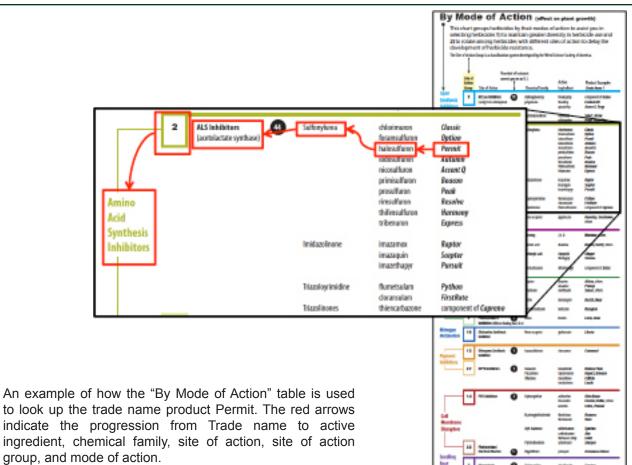
This chart it is premiched idea alphabetically by their task manus say was can identify the premich component herbicales and their respective site of action groups. Refer to the **Node of Action** chart on the left for more information.

The Corn and Soybean Herbicide Chart PDF can be downloaded by clicking on the image or going to: https://ag.purdue.edu/btny/ weedscience/Documents/Herbicide_MOA_CornSoy_12_2012%5B1%5D.pdf



By Premix					
This chard lists permits herbickles alphabetically by their itsele names aryon can kinetify the premit 's component herbickles and their					
repective site of action groups, liefer to the Mode of Action chart on the left for more information.					
Generat					
feeld Tede Name*	Test Sear"	Alle handed	Shot kites Group		
	Adam Cadar	Address of the	2		
Adapty Issue	1	manilepp	3		
Adamp Dei Adamp H/	ALC: N	damaier .	1		
Adam 1	inter la	ad Sale			
Adamilar	Adver	distants bisaftee	1		
Said Seried	lands.	filmations .	1		
Roy Liverson (Roy Live Take)	Incid Support	Lifections 1-certaintier disting	5		
handary	Incidegeon Incide	1-ortalector and disclo	-		
Institut 27 Sealine 2744	Alter lat	and a second	1		
Labor Do	Altra Late	dater -	-		
Camp	Altra	date	1		
Canage Cl	Centre Centre	distants	1		
Game	Spran	Tenature .	1		
DASKT DASKTAN	Add House	I satisfies			
Carves	Mana Sau	Tenuture Installe	1		
Dope The	Trans.	antellar data	-		
146	Carele Recovery	Ciprimana Diferentinos			
Talle	Contil	Contractor Contractor	1		
Taper .	No.	Barrisson in	8		
Litera	different of	dista di	-		
Total Inter	Caleson .	Patan			
Total Str.	Aller Aller	presenter .	1		
	Jahr Gentik	Cipinana di su	1		
Restar 2 Tuba	Factor distants	depinate depinate	-		
	Table II	Including Including			
Cangler Coattone Ma	Dellan	downlaw /	1		
G-Ren (br) Table (2	Inc Segme	etation 1-contraction	-		
	(ulter gryleute	disk adv	-		
lanes lin	All a	Children of Children			
land Indiple	Treasure Inc.	Annalisian Annalisian	1		
Sector	ide .	and the	8		
Region (A)	Allow Culture	Chip	-		
Longe 17	All and the party of the party	t metaletter distig	;		
	Inciding on	1 cathiction	8		
Kettine	Curty	durits dutie			
follor ball	Cath	Surfa			
Spell Press Plan	Parat .	ultimati intelligyr idiotallato	7		
True Pas	Trend Am	talouttana and a statement	1		
Tella	Incidence.	televiller serieler	-		
Propal	later Insis	tenandes tenañen	3		
Total Tia	head	teadate Incollegy	1		
Ballin Q	Page Calleo	tradition and the	4		
Braile ()	Sealer .	tealers Mealers			
liquin (Sector Cattor Sector	duntes duntes britan			
final Separate	Prest	wheele	-		
Separate	di planato	distante distante			
See.	loarter Arctive	24.0 substrame	11		
Spartier Charge	Speries	all discourse	1		
<u>इल</u>	Tel	program and	1		
Salar	Confy Austri	distanty -	-		
Sineferi (Acart () Becales	time from the second se	22		
2424	1	depended			
Spectrosp	Canal	distants Ultraffere	1		
19453	Armer Armer Mager	anticidar depende			
Mett	(TRUE	Summary Street	4		
terda:	Refer Canada Shariyan	distants whiteud	18		
Winstit		dappedd 7	1		
1den	Second Second	Surger Stands Manufares	1		
Desc	California Dani 1 Kayman	BACKER -	2		
Lepad provided by H and Peri Harawaya	Lapad preside by the Scherely of Massain's Rations				

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 the "By Premix" on the right.



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®).

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.

After outlining the site of action groups in program 1 you can see that this program contains a total of 5 site of action

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 S-metolachlor	14 15
Late Post	Cobra	lactofen	14

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 place on the group 14 herbicides and an adjustment would be recommended such as the following.

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 S-metolachlor	-14 - 15- -
	Liberty	glufosinate	10
	Dual II	S-metolachlor	15
Late Post	-Cobra -	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.

Using The Corn And Soybean Herbicide Chart To Outline Your Herbicide Program Site Of Action Rotation

Travis Legleiter Weed Science Program Specialist

Bill Johnson

Professor of Weed Science

Purdue University

PURDUE WEED SCIENCE



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

Agronomy Tips

April 26, 2013 • Page 8

Plentiful Winter and Spring Precipitation – Nitrogen Carryover Unlikely for Most of Indiana – (*Jim Camberato*¹)

Last year's drought and reduced corn yield in Indiana resulted in considerably more nitrogen (N) being left in the soil at the end of the growing season than normally occurs. Most of the leftover N was in the nitrate form which is subject to loss with excess soil moisture, both by drainage to the water table and via tile drains to the ditches and to the air through a process called denitrification².

A dry winter and spring would have allowed some of the nitrate to carry over to the upcoming corn crop. Unfortunately in most of Indiana the winter and early spring have been anything but dry.

Precipitation totals from late October through April (Fig. 1, upper panel) show that almost all of Indiana received more than 15 inches of precipitation during this 180 day span. Most of Indiana (except the southeast) received more precipitation than normal (Fig. 1, lower panel). Large areas of Indiana have received precipitation as much as 4 to 8 inches of above normal.

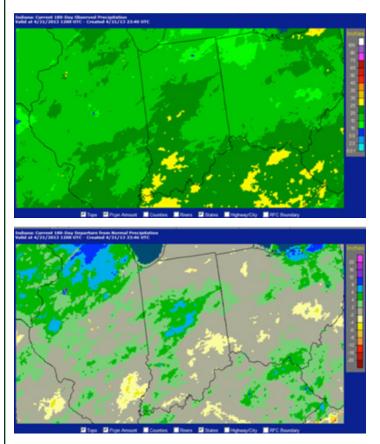


Fig. 1. Upper panel is the observed rainfall for Oct. 21, 2012 through April 21, 2013. Lower panel is the departure from normal rainfall for the same time period. Data from: National Weather Service http://water.weather.gov/precip/.

Soil Analysis for Nitrate

Typically in Indiana we do not have significant carryover N because winter and spring precipitation remove nitrate (NO_3) from the crop root zone. This year is no exception for most of the state. However, if you want to assess soil NO_3 levels directly, soil sampling can be used. Sample representative field areas at depth intervals of 0 to 1 foot and 1 to 2 foot (15-20 1-inch diameter cores for each depth, composited and subsampled). Keep samples cold or spread thin to air dry shortly after sampling to minimize changes in the NO_3 level of the sample. Send to a soil testing laboratory and request a NO_3 analysis.

Results of the soil analysis are usually reported in units of parts per million (ppm) as NO_3 or NO_3 -N. If reported in NO_3 divide by 4.5 to convert to NO_3 -N. Contact the laboratory performing the test if there is any confusion as to the unit reported. 1 ppm NO_3 -N in a 1 foot deep soil sample is equivalent to approximately 4 pounds of N per acre. Typical background NO_3 -N levels at corn sidedress time are in the range of 5 to 10 ppm or 20 to 40 pounds per acre.

Fate of Fall and Spring Anhydrous Ammonia

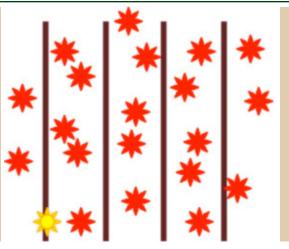
Anhydrous ammonia (AA) applied this spring, particularly in April, is unlikely to have been lost because it remained in the ammonium form (NH_4+) which is retained by the soil cation exchange capacity and is not subject to denitrification.² Anhydrous ammonia bands do not immediately convert to NO₃- because AA reduces the number of microbes that convert NH₄+ to NO₃-, particularly when cold temperatures also reduce recovery of the microbes. Loss of NO₃-N from late fall AA applications are likely also minimal because soil temperatures have been consistently cold throughout the winter. If in doubt soil sampling can be used to assess soil N levels in fields where AA (or manure) was applied with two modifications to the procedure outlined above.

Since both NH_4 and NO_3 are plant available and much of the NH_4 may not have been converted to NO_3 , request the laboratory measure both N forms. Most laboratories will report ppm of NH_4 -N, but if ppm NH_4 is reported divide by 1.3 to convert NH_4 to NH_4 -N. Background levels of NH4-N are typically less than 10 ppm at corn sidedress time.

Nitrogen fertilizer is one of the most expensive and impactful inputs in corn management. Excess applied N reduces profit and negatively impacts the environment. Insufficient N reduces yield and profit.

If you believe carryover N from last year's drought stricken crop is likely in your fields then soil sampling for NO_3 and/or NH_4 as a basis for a reduction in this year's fertilizer application is wise. Otherwise utilizing the general N recommendations (which are based on an average level

Measuring N from banded fertilizer or manure applications requires different soil sampling procedures than those needed for measuring carryover or broadcast fertilizer.³ If the direction and spacing of the bands cannot be discerned then obtain about twice as many cores as recommended for broadcast applications (30-40 per sample).



If the location of the band is known and on 30" centers take 1 core in the band and 20 outside the band (**diagram to left**).

If the direction, but not location of the band is known then take 20 pairs of cores - 1 core plus a second core half the band width away and perpendicular to the band direction.

of background N over the previous 7 years) are warranted. Read the most current Nitrogen Management Guidelines for Indiana⁴.

¹For more information, contact J. Camberato (765-496-9338, mailto:mjcambera@purdue.edu)

²NLossMechanismsandNitrogenUseEfficiency.Handout for 2006 Purdue Nitrogen Management Workshops. <<u>http://www.agry.purdue.edu/ext/pubs/2006NLossMechanisms.</u> pdf>. [URL accessed April 2013]

³Kitchen, N.R., J.L. Havlin, and D.G. Westfall. 1990. Soil sampling under no-till banded phosphorus. Soil Science Society of America Journal 54:1661-1665.

⁴Nitrogen Management Guidelines for Indiana. On-line at: http://www.agry.purdue.edu/ext/corn/news/timeless/ NitrogenMgmt.pdf>. [URL accessed April 2013].

Weather Update

Indiana's Weather Forecast - (*Jim Noel, NOAA/NWS/ Ohio River Forecast Center*) –

For Indiana, temperatures have been running normal for April with rainfall, as we all know, above normal. The above normal rainfall has been focused in the central combelt from Indiana west to eastern Iowa.

The outlook for the week of April 29 calls for above normal temperatures. Temperatures will retreat to below normal as we head into early to mid May again.

The rainfall outlook for the week of April 29 will be slightly below normal. The great uncertainty in the rainfall forecast in early May but our consensus weather models indicate about normal rainfall. This all hinges on a weather system that develops at the beginning of May. Some weather models take the storm mainly south of Indiana but some bring the rain back to areas of Indiana and points south and east.

A review of our outlook from last fall showed winter 2012/2013 would be slightly warmer and wetter than normal and that is exactly where the numbers came in. Our outlook for spring was for slightly warmer with normal to wetter than normal conditions. Based on where we are at, it looks like spring is on a target for near to slightly below normal temperatures when averaged out due to the cold March and precipitation wetter than normal. Overall, a fairly good outlook from late 2012. The biggest miss was the cold March that was not anticipated.

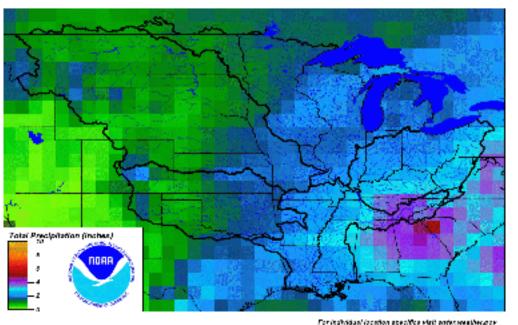
Soil moisture is in good condition across most of the corn and soybean belt in 2013. The exact opposite of 2012. Data continues to suggest a decent growing year compared to 2012 once the wet conditions relax.

The summer outlook continues to indicate an overall wash from June to August of not far from normal. However, within there are some important details. It looks like the summer starts warmer than normal and trends back to normal by August while the summer starts drier than normal in June and trends to above normal rainfall by August but averages out to a wash.

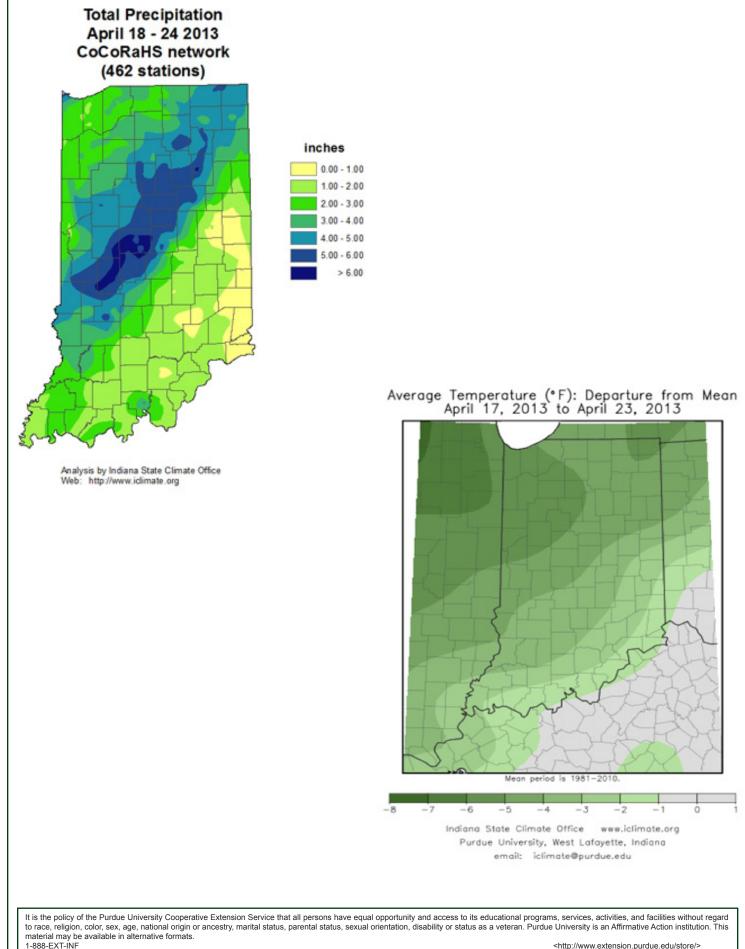
The long-term trends over many years looks to hold this year where we get a dry burst in either May or June each year then a wet burst often in late summer or fall. 2013 looks on track to see something like that with each year's magnitude changing. This years does not look as extreme as 2011 or 2012 for May through August which we have been saying since last summer and fall.

The 16-day rainfall outlook from the National Weather Service weather prediction model is attached below. It indicates on average 2 inches of rain in Indiana with most of that coming after May 2. However, there is a lot of uncertainty with the early May weather system. Over the next two weeks, this would bring Indiana rainfall closer in line with normal, but if wrong it favors still above normal rainfall.









<http://www.extension.purdue.edu/store/>