

Herbicide Resistance Management

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Herbicide resistance is becoming a serious problem in North Carolina and across the country. Herbicide resistance is not a new phenomenon in North Carolina. Goosegrass resistant to dinitroaniline herbicides was first reported in North Carolina in the 1970s. Since then, smooth pigweed and common lambsquarters resistant to triazines, cocklebur resistant to organoarsenicals and ALS inhibitors, Palmer amaranth resistant to ALS inhibitors, Italian ryegrass resistant to ACCase inhibitors and ALS inhibitors, and common ragweed resistant to ALS inhibitors have been observed. Of greatest concern is weed resistance to glyphosate. Horseweed (2003), Palmer amaranth (2005), common ragweed (2006), and Italian ryegrass (2009), resistant to glyphosate have been found. Resistance of common lambsquarters to glyphosate is suspected. Weed resistance to glyphosate is a highly significant concern in light of the extensive use of glyphosate for burndown in conservation tillage systems and in Roundup Ready cotton, soybeans, and corn.

Crop rotation, along with appropriate herbicide rotation, should be employed to the extent possible. Additionally, cultivation, where feasible, can be very helpful in herbicide resistance management. However, the most important component of a resistance management strategy is rotation of herbicide modes of action and use of multiple herbicide modes of action within each crop.

Mode of action describes the process whereby a herbicide kills susceptible plants. Table 8-11 lists the mode of action, along with the chemical family, of all the herbicides likely to be used on agronomic and horticultural crops in North Carolina. Each herbicide mode of action is assigned a numerical code for ease of use. Wherever possible, at least two modes of action should be used within each crop. This can be accomplished by preemergence herbicide applications followed by postemergence applications and by tank mixtures of herbicides with two or more modes of action. Also, within a rotation, one should try to avoid dependence on herbicides with the same mode of action in all crops in the rotation. For example, in a corn and soybean rotation, it is best not to use an ALS inhibitor (#2) in each crop. Alternatively, if an ALS inhibitor is used in each crop, herbicides with other modes of action should also be included. Similarly, it would be best to not rely exclusively on glyphosate in both crops.

In Roundup Ready corn and soybeans, it is recommended that glyphosate plus herbicides with at least one other mode of action be used. In Roundup Ready cotton, it is recommended that at least two modes of actions, in addition to glyphosate, be used.

TABLE 8-11A. HERBICIDE MODES OF ACTION

Brand Names	Active Ingredient(s)	Chemical Family	Mode of Action ¹
AAtrex	atrazine	triazine	5
Accent	nicosulfuron	sulfonylurea	2
Acumen	pendimethalin	dinitroaniline	3
Aim	carfentrazone	triazolinone	14
Alachlor	alachlor	chloroacetamide	15
Alanap	naptalam	phthalamate simicarbazon	19
Arrow	clethodim	cyclohexanedione	1
Atrazine	atrazine	triazine	5
Assure II	quizalofop	aryloxyphenoxy-propionate	1
Authority Assist	sulfentrazone + imazethapyr	triazolinone + imidazolinone	14 + 2
Authority First	sulfentrazone + cloransulam	triazolinone + triazolopyrimidine	14 + 2
Authority MTZ	sulfentrazone + metribuzin	triazolinone + triazinone	14 + 5
Axial	pinoxaden	phenylpyrazoline	1
Axiom	flufenacet + metribuzin	oxyacetamide + triazinone	15 + 5
Banvel	dicamba	benzoic acid	4
Banvel-K + Atrazine	dicamba + atrazine	benzoic acid + triazine	4 + 5
Basagran	bentazon	benzothiadiazinone	6
Basis	rimsulfuron + thifensulfuron	sulfonylurea	2 + 2
Beyond	imazamox	imidazolinone	2
Bicep II Magnum	s-metolachlor + atrazine	chloroacetamide + triazine	15 + 5
Blazer	acifluorfen	diphenylether	14
Boundary	s-metolachlor + metribuzin	chloroacetamide + triazinone	15 + 5
Brawl, Brawl II	s-metolachlor	chloroacetamide	15

TABLE 8-11A. HERBICIDE MODES OF ACTION

Brand Names	Active Ingredient(s)	Chemical Family	Mode of Action ¹
Brawl II ATZ	s-metolachlor + atrazine	chloroacetamide + triazine	15 + 5
Breakfree ATZ	s-metolachlor + atrazine	chloroacetamide + triazine	15 + 5
Break-Up	pronamide	benzamide	3
Buctril	bromoxynil	nitrile	6
Bullet	alachlor + atrazine	chloroacetamide + triazine	15 + 5
Butoxone	2,4-DB	phenoxy-carboxylic acid	4
Butyrac	2,4-DB	phenoxy-carboxylic acid	4
Cadre	imazapic	imidazolinone	2
Callisto	mesotrione	triketone	27
Camix	mesotrione + s-metolachlor	triketone + chloroacetamide	27 + 15
Canopy	metribuzin + chlorimuron	triazine + sulfonyleurea	5 + 2
Canopy EX	chlorimuron + tribenuron	sulfonyleurea + sulfonyleurea	2 + 2
Canopy XL	sulfentrazone + chlorimuron	diphenylether + sulfonyleurea	14 + 2
Caparol	prometryn	triazine	5
Capreno	tembotrione + thiencazone	benzoyl pyrazole + triazolone	27 + 2
Celebrity, Celebrity Plus	nicosulfuron + dicamba	sulfonyleurea + benzoic acid	2 + 4
Charger Basic	s-metolachlor	chloroacetamide	15
Cinch	s-metolachlor	chloroacetamide	15
Cinch ATZ	s-metolachlor + atrazine	chloroacetamide + triazine	15 + 5
Clarity	dicamba	benzoic acid	4
Classic	chlorimuron	sulfonyleurea	2
Clethodim	clethodim	cyclohexanedione	1
Clopyr AG	clopyralid	pyridine carboxylic acid	4
Cobra	lactofen	diphenylether	14
Command	clomazone	isoxazolidinone	13
Confidence	acetochlor	chloroacetamide	15
Confidence Xtra	acetochlor + atrazine	chloroacetamide + triazine	15 + 5
Cotoran	fluometuron	urea	7
Cotton-Pro	prometryne	triazine	5
Curbit	ethalfuralin	dinitroaniline	3
Dacthal	DCPA	benzoic acid	3
Dawn	fomesafen	diphenyl ether	14
Define	flufenacet	oxyacetamide	15
Degree	acetochlor	chloroacetamide	15
Degree Xtra	acetochlor + atrazine	chloroacetamide + triazine	15 + 5
Devrinol	napropamide	acetamide	15
Diablo	dicamba	benzoic acid	4
Dicamba DMA Salt	dicamba	benzoic acid	4
Direx	diuron	urea	7
Distinct	dicamba + diflufenzopyr	benzoic acid + semicarbazone	4 + 19

TABLE 8-11A. HERBICIDE MODES OF ACTION

Brand Names	Active Ingredient(s)	Chemical Family	Mode of Action ¹
Diuron	diuron	urea	7
Double Team	acetochlor + atrazine	chloroacetamide + triazine	15 + 5
DSMA, numerous brands	DSMA	organoarsenical	17
Dual II, Dual II Magnum	s-metolachlor	chloroacetamide	15
Envive	flumioxazim + chlorimuron + thifensulfuron	n-phenylphthalimide + triazolopyrimidine + sulfonyleurea	14 + 2 + 2
Envoke	trifloxysulfuron	sulfonyleurea	2
Eptam	EPTC	thiocarbamate	8
Equip	formasulfuron + iodosulfuron	sulfonyleurea	2 + 2
Eradicane	EPTC	thiocarbamate	8
Establish	dimethenamid	chloroacetamide	15
Establish ATZ	dimethenamid + atrazine	chloroacetamide + triazine	15 + 5
ET	pyraflufen ethyl	phenylpyrazole	14
Evik	ametryne	triazine	5
Expert	glyphosate + s-metolachlor + atrazine	glycine + chloroacetamide + triazine	9 + 15 + 5
Express	tribenuron	sulfonyleurea	2
Extreme	glyphosate + imazethapyr	glycine + imidazolinone	9 + 2
Finesse	chlorsulfuron + metsulfuron	sulfonyleurea + sulfonyleurea	2 + 2
Firestorm	paraquat	bipyridylum	22
Firstrate	cloransulam	triazolopyrimidine	2
Flexstar	fomesafen	diphenylether	14
Fultime	acetochlor + atrazine	chloroacetamide + triazine	15 + 5
Fusilade DX	fluazifop	aryloxyphenoxy-propionate	1
Fusion	fluazifop + fenoxaprop	aryloxyphenoxy-propionate + aryloxyphenoxy-propionate	1 + 1
Galigan	oxyfluorfen	diphenylether	14
Gangster	flumioxazin + cloransulam	n-phenylphthalimide + triazolopyrimidine	14 + 2
Guardsman Max	dimethenamid + atrazine	chloroacetamide + triazine	15 + 5
Glyphosate (numerous brands)	glyphosate	glycine	9
Goal	oxyfluorfen	diphenylether	14
Goal Tender	oxyfluorfen	diphenylether	14
Gramoxone (Inteon)	paraquat	bipyridylum	22
Halex GT	s-metolachlor + glyphosate + mesotrione	chloroacetamide + glycine + triketone	15 + 9 + 27
Harmony Extra	thifensulfuron + tribenuron	sulfonyleurea + sulfonyleurea	2 + 2
Harmony GT, Harmony SG	thifensulfuron	sulfonyleurea	2
Harness	acetochlor	chloroacetamide	15
Harness Xtra	acetochlor + atrazine	chloroacetamide + triazine	15 + 5
Hoelon	diclofop	aryloxyphenoxy-propionate	1
Ignite, Ignite 280	glufosinate	phosphinic acid	10
Impact	topramazone	triketone	27
Intrro	alachlor	chloroacetamide	15
Karmex	diuron	urea	7

TABLE 8-11A. HERBICIDE MODES OF ACTION

Brand Names	Active Ingredient(s)	Chemical Family	Mode of Action ¹
Kerb	pronamide	benzamide	3
Keystone	acetochlor + atrazine	chloroacetamide + triazine	15 + 5
Lariat	alachlor + atrazine	chloroacetamide + triazine	15 + 5
Laudis	tembotrione	benzoyl pyrazole	27
Layby Pro	diuron + linuron	urea + urea	7 + 7
Lexar	mesotrione + s-metolachlor + atrazine	triketone + chloroacetamide + triazine	27+15+5
Liberty	glufosinate	phosphinic acid	10
Liberty ATZ	glufosinate + atrazine	phosphinic acid + triazine	10 + 5
Lightning	imazethapyr + imazapyr	imidazolinone + imidazolinone	2 + 2
Linex	linuron	urea	7
Lorox	linuron	urea	7
Lumax	mesotrione + s-metolachlor + atrazine	triketone + chloroacetamide + atrazine	27+15+5
Marksman	dicamba + atrazine	benzoic acid + triazine	4 + 5
Matrix	rimsulfuron	sulfonylurea	2
Medal, Medal II	s-metolachlor	chloroacetamide	15
Medal II AT	s-metolachlor + atrazine	chloroacetamide + triazine	15 + 5
Me-Too-Lachlor	metolachlor	chloroacetamide	15
Metribuzin	metribuzin	triazinone	5
Metri DF	metribuzin	triazinone	5
Micro-Tech	alachlor	chloroacetamide	15
Moxy	bromoxynil	nitrile	6
MSMA (numerous brands)	MSMA	organoarsenical	17
OpTILL	imazethapyr + saflufenacil	imidazolinone + pyrimidinedione	2 + 14
Option	foramsulfuron	sulfonylurea	2
Osprey	mesosulfuron	sulfonylurea	2
Outlook	dimethenamid	chloroacetamide	15
OxiFlo	oxyfluorfen	diphenylether	14
Parallel, Parallel PCS	metolachlor	chloroacetamide	15
Parallel Plus	metolachlor + atrazine	chloroacetamide + atrazine	15 + 5
Parazone	paraquat	bipyridylum	22
Parrlay	metolachlor	chloroacetamide	15
Peak	prosulfuron	sulfonylurea	2
Pendant	pendimethalin	dinitroaniline	3
Pendimax	pendimethalin	dinitroaniline	3
Permit	halosulfuron	sulfonylurea	2
Poast, Poast Plus	sethoxydim	cyclohexanedione	1
PowerFlex	pyrosulam	triazolopyrimidine	2
Prefar	bensulide	phosphorodithioate	8
Prefix	s-metolachlor + fomesafen	chloroacetamide + diphenylether	15 + 14

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Brand Names	Active Ingredient(s)	Chemical Family	Mode of Action ¹
Princep	simazine	triazine	5
Prometryn	prometryn	triazine	5
Prowl, Prowl H ₂ O	pendimethalin	dinitroaniline	3
Pursuit	imazethapyr	imidazolinone	2
Pyramin	pyrazon	pyridazinone	6
Python	flumetsulam	triazolopyrimidine	2
Raptor	imazamox	imidazolinone	2
Reflex	fomesafen	diphenylether	14
Resolve	rimsulfuron	sulfonylurea	2
Resolve Q	rimsulfuron + thifensulfuron	sulfonylurea + sulfonylurea	2 + 2
Resource	flumiclorac-pentyl	n-phenylphthalimide	14
Ro-Neet	cycloate	thiocarbamate	8
Roundup (and other brands)	glyphosate	glycine	9
Rythm	fomesafen	diphenyl ether	14
Sandea	halosulfuron	sulfonylurea	2
Scepter	imazaquin	imidazolinone	2
Select, Select Max	clethodim	cyclohexanedione	1
Sencor	metribuzin	triazinone	5
Sequence	glyphosate + s-metolachlor	glycine + chloroacetamide	9 + 15
Sharpen	saflufenacil	pyrimidinedione	14
Simazine	simazine	triazine	5
Sim-Trol	simazine	triazine	5
Sinbar	terbacil	uracil	5
Sonalan	ethalfuralin	dinitroaniline	3
Sonic	sulfentrazone + cloransulam	triazolinone + triazolopyrimidine	14 + 2
Spartan	sulfentrazone	triazolinone	14
Spartan Charge	sulfentrazone + carfentrazone	triazolinone + triazolinone	14 + 14
Spin-Aid	phenmedipham	phenyl-carbamate	6
Squadron	imazaquin + pendimethalin	imidazolinone + dinitroaniline	2 + 3
Stalwart, Stalwart C	metolachlor	chloroacetamide	15
Stalwart Xtra	metolachlor + atrazine	chloroacetamide + triazine	15 + 5
Staple	pyrithiobac	pyrimidinyl(thio)benzoate	2
Status	dicamba + diflufenzopyr	benzoic acid + semicarbazone	4 + 19
Steadfast, Steadfast Q	nicosulfuron + rimsulfuron	sulfonylurea + sulfonylurea	2 + 2
Steadfast ATZ	nicosulfuron + rimsulfuron + atrazine	sulfonylurea + sulfonylurea + triazine	2 + 2 + 5
Stealth	pendimethalin	dinitroaniline	3
Sterling	dicamba	benzoic acid	4
Stinger	clopyralid	pyridine carboxylic acid	4
Storm	acifluorfen + bentazon	diphenylether + benzothiadiazinone	14 + 6
Stout	nicosulfuron + thifensulfuron	sulfonylurea + sulfonylurea	2 + 2

TABLE 8-11A. HERBICIDE MODES OF ACTION

Brand Names	Active Ingredient(s)	Chemical Family	Mode of Action ¹
Strategy	ethalfuralin + clomazone	dinitroaniline + isoxazolidinone	3 + 13
Strongarm	diclosulam	triazolopyrimidine	2
Suprend	prometryn + trifloxysulfuron	triazine + sulfonyleurea	5 + 2
Sutan ⁺	butylate	thiocarbamate	8
Surpass	acetochlor	chloroacetamide	15
Synchrony XP	chlorimuron + thifensulfuron	sulfonyleurea + sulfonyleurea	2 + 2
Targa	quizalofop	aryloxyphenoxy-propionate	1
Tillam	pebulate	thiocarbamate	8
TopNotch	acetochlor	chloroacetamide	15
Treflan	trifluralin	dinitroaniline	3
Triangle	metolachlor + atrazine	chloroacetamide + triazine	15 + 5
Trifluralin	trifluralin	dinitroaniline	3
Trigger	clethodim	cyclohexanedione	1
Trilin	trifluralin	dinitroaniline	3
Trizmet II	atrazine + metolachlor	triazine + chloroacetamide	5 + 15
Trust	trifluralin	dinitroaniline	3
Ultra Blazer	acifluorfen	diphenylether	14
Valor SX	flumioxazin	n-phenylphthalimide	14
Valor XLT	flumioxazin + chlorimuron	n-phenylphthalimide + sulfonyleurea	14 + 2
Vision	dicamba	benzoic acid	4
Volley	acetochlor	chloroacetamide	15
Volley ATZ	acetochlor + atrazine	chloroacetamide + triazine	15 + 5
Volunteer	clethodim	cyclohexanedione	1
Warrant	acetachlor	chloroacetamide	15
Weedmaster	2,4-D + dicamba	phenoxy-carboxylic acid + benzoic acid	4 + 4
Yukon	halosulfuron + dicamba	sulfonyleurea + benzoic acid	2 + 4
2,4-D (numerous brands)	2,4-D	phenoxy-carboxylic acid	4
2,4-DB (numerous brands)	2,4-DB	phenoxy-carboxylic acid	4

Mode of Action Code Key:

- 1 ACCase inhibition
- 2 ALS inhibition
- 3 Microtubule assembly inhibition
- 4 Synthetic auxin
- 5 Photosystem II inhibition, different binding behavior than groups 6 and 7
- 6 Photosystem II inhibition, different binding behavior than groups 5 and 7
- 7 Photosystem II inhibition, different binding behavior than groups 5 and 6
- 8 Inhibition of lipid synthesis - not ACCase inhibition
- 9 EPSP synthase inhibition
- 10 Glutamine synthase inhibition
- 12 Inhibition of carotenoid biosynthesis at PDS
- 13 Inhibition of carotenoid biosynthesis, unknown target
- 14 PPO inhibition
- 15 Inhibition of very long-chain fatty acids
- 17 Unknown mode of action
- 19 Auxin transport inhibition
- 22 Photosystem I electron diversion
- 27 Inhibition of HPPD

TABLE 8-11B. HERBICIDE MODES OF ACTION FOR HAY CROPS, PASTURES, LAWNS AND TURF

Brand Names	Active Ingredient(s)	Chemical Family	Mode of Action ¹
Aatrex, Purge	atrazine	triazine	5
Acclaim Extra	fenoxaprop	aryloxyphenoxy propionate	1
Aim, QuickSilver	carfentrazone	triazinone	14
Asulox	asulam	carbamate	18
Balan	benefin	dinitroaniline	3
Banvel, Vanquish	dicamba	benzoic acid	4
Barricade, Prodiamine, Regalkade	prodiamine	dinitroaniline	3
Basagran T/O, Lescogran	bentazon	benzothiadiazole	6
Bensumec, Betasan, Presan	bensulide	organophosphorus	8
Blade, Cimarron, Manor, MSM Turf, Patriot	metsulfuron	sulfonylurea	2
Boa, Gramoxone Max	paraquat	bipyridylum	22
Buctril	bromoxynil	nitrile	6
Campaign	2,4-D + glyphosate	phenoxy-carboxylic acid + glycine	4 + 9
Celsius	thiencarbazone + iodosulfuron + dicamba	triazolinone + sulfonylurea + benzoic acid	14 + 2 + 4
Certainty, Outrider	sulfosulfuron	sulfonylurea	2
Chaparral	aminopyralid + metsulfuron	pyridinecarboxylic acid + sulfonylurea	4 + 2
Cimarron Max	metsulfuron + 2,4-D + dicamba	sulfonylurea + phenoxy-carboxylic acid + benzoic acid	2 + 4 + 4
Cimarron Plus	metsulfuron + chlorsulfuron	sulfonylurea + sulfonylurea	2 + 2
Confront, Redeem R&P	triclopyr + clopyralid	pyridinecarboxylic acid + pyridinecarboxylic acid	4 + 4
Cool Power	MCPA ester + triclopyr ester + dicamba	phenoxy + pyridinecarboxylic acid + benzoic acid	4 + 4 + 4
Corsair, Telar XP	chlorsulfuron	sulfonylurea	2
Crossbow	2,4-D + triclopyr	phenoxy-carboxylic acid + pyridinecarboxylic acid	4 + 4
Curtail	2,4-D + clopyralid	phenoxy-carboxylic acid + pyridinecarboxylic acid	4 + 4
Devrinol	napropamide	acetamide	15
Dimension, Dithiopyr	dithiopyr	pyridine	4
Direx	diruon	phenylurea	7
Dismiss	sulfentrazone	triazinone	14
Dismiss South	sulfentrazone + imazethapyr	triazinone + imidazolinone	14 + 2
Drive, Drive XLR8, Quinclorac	quinclorac	quinoline carboxylic acid	(27 + 4)
Echelon	sulfentrazone + prodiamine	triazinone + dinitroaniline	14 + 3
Envoy Plus, Select	clethodim	cyclohexanedione	1
Eptam	EPTC	thiocarbamate	8
Escalade, Escalade 2	2,4-D + fluroxypyr + dicamba	phenoxy + pyridinecarboxylic acid + benzoic acid	4 + 4 + 4
Finale	glufosinate	organophosphorus	10
Forefront	2,4-D + aminopyralid	phenoxy-carboxylic acid + pyridinecarboxylic acid	4 + 4
Fusilade II	fluazifop	aryloxyphenoxy propionate	1
Gallery	isoxaben	benzamide	21
Glypro, Glyphosate T&O, Razor, Razor Pro, Roundup formulations, Touchdown Pro	glyphosate	glycine	9
Goosegrass / Crabgrass Control	bensulide + oxadiazon	organophosphorus + oxadiazole	8 + 14
Grazon P+D	2,4-D + picloram	phenoxy-carboxylic acid + pyridinecarboxylic acid	4 + 4
Harrier WDG, Oryzalin 4 Pro, Surflan	oryzalin	dinitroaniline	3
Horsepower	MCPA amine + triclopyr amine + dicamba	phenoxy + pyridinecarboxylic acid + benzoic acid	4 + 4 + 4
Illoxan	diclofop	aryloxyphenoxy propionate	1
Image	imazaquin	imidazolinone	2

TABLE 8-11B. HERBICIDE MODES OF ACTION FOR HAY CROPS, PASTURES, LAWNS AND TURF

Brand Names	Active Ingredient(s)	Chemical Family	Mode of Action ¹
Journey	imazapic + glyphosate	imadazolinone + glycine	2 + 9
Kerb	pronamide	benzamide	3
Lockup	penoxsulam	triazolopyrimidine	2
Lontrel	clopyralid	pyridinecarboxylic acid	4
MCPP	mecoprop	phenoxyalkanoic acid	4
Milestone	aminopyralid	pyradinecarboxylic acid	4
Millennium Ultra	2,4-D + clopyralid + dicamba	phenoxy-carboxylic acid + pyridinecarboxylic acid + benzoic acid	4 + 4 + 4
Millennium Ultra Plus	monosodium methylarsonate + 2,4-D + clopyralid + dicamba	organic arsenical + phenoxy-carboxylic acid + pyridinecarboxylic acid + benzoic acid	17 + 4 + 4 + 4
Monument	trifloxysulfuron	sulfonylurea	2
MSMA	monosodium methylarsonate	organic arsenical	17
Octane	pyraflufen ethyl	phenylpyrazole	14
Onetime	quinclorac + mecoprop + dicamba	quinoline carboxylic acid + phenoxyalkanoic acid + benzoic acid	(27 + 4) + 4 + 4
Oxadiazon and Ronstar formulations, Starfighter L	oxadiazon	oxadiazole	14
Overdrive	diflufenzopyr + dicamba	semicarbazone + benzoic acid	19 + 4
Panoramic, Plateau	imazapic	imadazolinone	2
Pastora	nicosulfuron + metsulfuron	sulfonylurea + sulfonylurea	2 + 2
PastureGard	triclopyr + fluroxypyr	pyradinecarboxylic acid + pyradinyloxyacetic acid	4 + 4
Pendulum, Pre-M, Prowl H2O, Weedgrass Control	pendimethalin	dinitroaniline	3
Pennant, Pennant Liquid	metolachlor	chloroacetamide	15
Poa Constrictor, Prograss	ethofumesate	benzofuranes	8
Poast, Poast Plus, Segment	sethoxydim	cyclohexanedione	1
Power Zone	carfentrazone + MCPA + mecoprop + dicamba	triazinone + phenoxy + phenoxyalkanoic acid + benzoic acid	14 + 4 + 4 + 4
Princep, Regal Wynstar	simazine	triazine	5
Prompt	bentazon + atrazine	benzothiadiazole + triazine	6 + 5
Pursuit	imazethapyr	imidazolinone	2
Q4	quinclorac + sulfentrazone + 2,4-D + dicamba	quinoline carboxylic acid + triazinone + phenoxy-carboxylic acid + benzoic acid	(27 + 4) + 14 + 4 + 4
QuikPRO, Razor Burn	glyphosate + diquat	glycine + bipyridilium	9 + 22
Quincept	quinclorac + 2,4-D + dicamba	quinoline carboxylic acid + phenoxy-carboxylic acid + benzoic acid	(27 + 4) + 4 + 4
Rage D-Tech	2,4-D + carfentrazone	phenoxy-carboxylic acid + triazolinone	4 + 14
Regalstar	oxadiazon + benefin	oxadiazole + dinitroaniline	14 + 3
Regalstar II	oxadiazon + prodiamine	oxadiazole + dinitroaniline	14 + 3
Remedy, Remedy Ultra, Turflon Ester Ultra	triclopyr	pyradinecarboxylic acid	4
Revolver	foramsulfuron	sulfonylurea	2
Reward LS	diquat	bipyridilium	22
Rubigan	fenarimol	substituted pyrimidine	-
Sedgehammer	halosulfuron	sulfonylurea	2
Sencor	metribuzin	triazinone	5
Sinbar	terbacil	uracil	5
Solitare	sulfentrazone + quinclorac	triazinone + quinoline carboxylic acid	14 + (27 + 4)
Specticle	indaziflam	benzamide	21
Speed Zone, Speed Zone Southern	carfentrazone + 2,4-D + mecoprop + dicamba	triazinone + phenoxy-carboxylic acid + phenoxyalkanoic acid + benzoic acid	14 + 4 + 4 + 4
Spike	tebuthiuron	thiadiazolyurea	7

TABLE 8-11B. HERBICIDE MODES OF ACTION FOR HAY CROPS, PASTURES, LAWNS AND TURF

Brand Names	Active Ingredient(s)	Chemical Family	Mode of Action ¹
Spotlight	fluroxypyr	pyridinyloxyacetic acid	4
Surge	sulfentrazone + 2,4-D + mecoprop + dicamba	triazinone + phenoxy-carboxylic acid + phenoxyalkanoic acid + benzoic acid	14 + 4 + 4 + 4
Surmount	picloram + fluroxypyr	pyradinecarboxylic acid + pyradinyloxyacetic acid	4 + 4
Team	benefin + trifluralin	dinitroaniline + dinitroaniline	3 + 3
Tenacity	mesotrione	benzoylcyclohexanedione	27
Tower	dimethenamid	chloroacetamide	15
TranXit GTA	rimsulfuron	sulfonylurea	2
Treflan	trifluralin	dinitroaniline	3
Tri-Power	MCPA + mecoprop + dicamba	mcpa + phenoxyalkanoic acid + benzoic acid	4 + 4 + 4
Trimec, Triplet, Three-Way	2,4-D + mecoprop + dicamba	phenoxy-carboxylic acid + phenoxyalkanoic acid + benzoic acid	4 + 4 + 4
Trimec Plus	monosodium methylarsonate + 2,4-D + mecoprop+ dicamba	organic arsenical + phenoxy-carboxylic acid + phenoxyalkanoic acid + benzoic acid	17 + 4 + 4 + 4
Tupersan	siduron	phenylurea	7
Tzone	triclopyr + sulfentrazone + 2,4-D + dicamba	pyridinecarboxylic acid + triazinone + phenoxy-carboxylic acid + benzoic acid	4 + 14 + 4 + 4
Velocity	bispyribac-sodium	pyrimidinyloxybenzoic acid	2
Weedmaster	2,4-D + dicamba	phenoxy-carboxylic acid + benzoic acid	4 + 4
2,4-DB	2,4-DB	phenoxy-carboxylic acid	4
2,4-D amine	2,4-D	phenoxy-carboxylic acid	4

¹Mode of Action Code Key:

- 1 Acetyl CoA Carboxylase (ACCase) Inhibitors
- 2 Acetolactate Synthase (ALS) or Acetohydroxy Acid Synthase (AHAS) Inhibitors
- 3 Mitosis Inhibitors that inhibit polymerization of microtubules
- 4 Synthetic Auxins
- 5 Photosystem II Inhibitors that bind differently than groups 6 and 7
- 6 Photosystem II Inhibitors that bind differently than groups 5 and 7
- 7 Photosystem II Inhibitors that bind differently than groups 5 and 6
- 8 Fatty Acid and Lipid Biosynthesis Inhibitors
- 9 Enolpyruvyl Shikimate-3-Phosphate (EPSP) Synthase Inhibitors
- 10 Glutamine Synthetase Inhibitors
- 14 Protoporphyrinogen Oxidase (PPG oxidase or Protox) Inhibitors
- 15 Mitosis Inhibitors that inhibit very long chain fatty acid synthesis
- 17 Potential Nucleic Acid Inhibitors or Non-descript mode of action
- 18 Dihydropteroate Synthetase Inhibitors
- 19 Auxin Transport Inhibitors
- 21 Cellulose Inhibitors
- 22 Photosystem I Inhibitors
- 27 Cellulose Inhibitors