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PB1775 Common Commercial Pre-packaged Herbicide Mixtures

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Recommended Citation
"PB1775 Common Commercial Pre-packaged Herbicide Mixtures," The University of Tennessee Agricultural Extension Service, 08-0158 PB1775-2.5M-3/08 E12-5115-00-011-08, http://trace.tennessee.edu/utk_agexcrop/65

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UT Extension
PB1775

Common Commercial Pre-packaged Herbicide Mixtures

Photo courtesy of Larry Steckel

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THE UNIVERSITY of TENNESSEE UT
INSTITUTE of AGRICULTURE

COMMON PRE-PACKAGED HERBICIDE MIXTURES- Updated January 4, 2008*

Common Pre-packaged Herbicides and Common Names, Ratios and Site/Mode of Action of the Component Chemicals

Trade Name	Company	Common Name of Individual Herbicides [percent ai (liquid or dry) or lbs ai/gal (liquid) or lb ai/ lb product (dry) represented in parentheses]	Site/Mode of action of herbicides represented in this product†^
875 BrushKiller	PBI Gordon	2,4-D (1.81 lbs or 19.49%) + mecoprop-p (0.96 lb or 10.37%) + dicamba (0.32 lb or 3.52%)	auxin mimic- 1 (O)
ACE Dilutable Concentrate Lawn Weed Killer	Chemsico	2,4-D (0.54 lb) + mecoprop-p (0.13 lb) + dicamba (0.06 lb)	auxin mimic- 1 (O)
Accent Gold	DuPont	clopyralid (51.4%) + flumetsulam (15.9%) + nicosulfuron (5.4%) + rimsulfuron (5.4%)	ALS-inhibitors- 2 (B), auxin mimic- 1 (O)
Affinity Broadspec	DuPont	tribenuron (25%) + thifensulfuron (25%)	ALS-inhibitors- 2 (B)
Affinity Tank Mix	DuPont	tribenuron (10%) + thifensulfuron (40%)	ALS-inhibitors- 2 (B)
Agility SG	DuPont	tribenuron (2.4%) + thifensulfuron (4.7%) + metsulfuron (1.9%) + dicamba (57.8%)	ALS-inhibitors- 2 (B), auxin mimic- 1 (O)
All-In-One Lawn Weed & Crabgrass Killer Ready-to-spray	Bayer Advanced	2,4-D (4.03%) + quinclorac (1.61%) + dicamba (0.37%)	auxin mimic- 1 (O)
All-In-One Weed Killer for Lawns Concentrate	Bayer Advanced	MSMA (9.81%) + 2,4-D (2.64%) + mecoprop-p (1.32%) + dicamba (0.66%)	unknown- 17 (Z)- organoarsenicals, auxin mimic- 1 (O)
All-In-One Weed Killer for Lawns Ready-to-use	Bayer Advanced	MSMA (0.36%) + 2,4-D (0.1%) + mecoprop-p (0.05%) + dicamba (0.02%)	unknown- 17 (Z)- organoarsenicals, auxin mimic- 1 (O)
AllPro BK32 Brush Killer	Value Garden Supply	2,4-D (0.92 lbs or 10.6%) + dichlorprop-p (0.94 lb or 10.9%)	auxin mimic- 1 (O)
All-Season Brush-No-More	PBI Gordon	2,4-D (0.49 lb or 6.46%) + dichlorprop-p (0.24 lb or 3.23%) + dicamba (0.12 or 1.65%)	auxin mimic- 1 (O)
Ally Extra	DuPont	tribenuron (18.75%) + thifensulfuron (37.5%) + metsulfuron (15%)	ALS-inhibitors- 2 (B)
Arrosolo 3.3E	RiceCo.	molinate (33.1%) + propanil (33.1%)	Inhibitor of lipid synthesis- 8 (N), PSII site A2- 7 (C2)
Atra-bute	Syngenta	atrazine (14.2%) + butylate (56.8%)	PSII site A- 5 (C1), inhibitor of lipid Synthesis- 8 (N)
Authority First	FMC	sulfentrazone (62.1%) + cloransulam-methyl (7.9%)	PPO inhibitor- 14 (E), ALS-inhibitor- 2 (B)
Authority MTZ	FMC	sulfentrazone (18%) + metribuzin (27%)	PPO inhibitor- 14 (E),
Axiom	Bayer	flufenacet (54.4%) + metribuzin (13.6%)	Inhibitor of very long chain fatty acid

Trade Name	Company	Common Name of Individual Herbicides [percent ai (liquid or dry) or lbs ai/gal (liquid) or lb ai/ lb product (dry) represented in parentheses]	Site/Mode of action of herbicides represented in this product†^
			biosynthesis- 15 (K3), PSII site A- 5 (C1)
Axiom AT	Bayer	flufenacet (19.6%) + metribuzin (4.9%) + atrazine (50.5%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Backdraft	BASF	glyphosate (14.1% as its isopropylamine salt) + imazaquin (2.8%)	EPSP synthase- 9 (G), ALS-inhibitor- 2 (B)
Banvel + 2,4-D	Micro Flo/Arysta	dicamba (1 lb or 10.3%) + 2,4-D (2.87 lb or 29.6%)	auxin mimic- 1 (O)
Banvel 720	Syngenta/BASF	dicamba (1 lb) + 2,4-D (1.9 lbs)	auxin mimic- 1 (O)
Banvel-K + Atrazine	Micro Flo/Arysta	dicamba (1.1 lbs or 11.45%) + atrazine (2.1 lbs or 22.23%)	auxin mimic- 1 (O), PSII site A- 5 (C1)
Barespot Monobor-chlorate	Pro-Serve	sodium chlorate (30%) + sodium metaborate (48.5%)	unknown- 26 (Z)- fumigants
Basic Solutions Lawn Weed Killer	Ortho	2,4-D (0.26 lb) + dichlorprop-p (0.13 lb) + mecoprop-p (0.13 lb)	auxin mimic- 1 (O)
Basis	DuPont	rimsulfuron (50%) + thifensulfuron (25%)	ALS-inhibitors- 2 (B)
Basis Gold	DuPont	atrazine (82.4%) + nicosulfuron (1.34%) + rimsulfuron (1.34%)	ALS-inhibitors- 2 (B), PSII site A- 5 (C1)
Battleship	Helena	triclopyr (0.27 lb) + clopyralid (0.13 lb) + MCPA (3 lbs)	auxin mimic- 1 (O)
Betamix	Bayer	desmedipham (8%) + phenmedipham (8%)	PSII site A- 5 (C1)
Bicep	Syngenta	atrazine (2.67 lbs or 28.9%- atrazine + related triazines) + metolachlor (3.28 lbs or 35.6%%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Bicep Lite	Syngenta	atrazine (1.67 lbs or 18.3%- atrazine + related triazines) + metolachlor (3.35 lbs or 36.6%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Bicep II	Syngenta	atrazine (2.67 lbs or 28.8%- atrazine + related triazines) + metolachlor (3.18 lbs or 34.8%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Bicep Lite II	Syngenta	atrazine (1.67 lbs or 18.3%- atrazine + related triazines) + metolachlor (3.23 lbs or 35.3%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Bicep II Magnum	Syngenta	atrazine (3.1 lbs or 33.7%- atrazine + related triazines) + s-metolachlor (2.4 lbs or 26.1%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Bicep II Magnum FC	Syngenta	atrazine (3.1 lbs or 33.7%- atrazine + related triazines) + s-metolachlor (2.4 lbs or 26.1%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Bicep Lite II Magnum	Syngenta	atrazine (2.67 lbs or 28.7%- atrazine + related triazines) + s-metolachlor (3.33 lbs or 35.8%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Bison	Agriliance	bromoxynil (2 lbs or 21.8%) + MCPA (2 lbs or 21.8%)	PSII site B- 6 (C3), auxin mimic- 1 (O)
Bison Advanced	Agriliance	bromoxynil (2.5 lbs) + MCPA (2.5 lbs)	PSII site B- 6 (C3), auxin mimic- 1 (O)
BnB Plus	United Phosphorous/ Cerexagri	phenmedipham (0.6 lb or 7%) + desmedipham (0.6 lb or 7%) + ethofumesate (0.6 lb or 7%)	PSII site A- 5 (C1), Shoot inhibitor through Inhibition of cell division- unknown site- 17 (N)
Boundary 6.5EC	Syngenta	s-metolachlor (5.25 lbs or 58.2%) + metribuzin (1.25 lbs or 13.8%)	Inhibitor of very long chain fatty acid Biosynthesis- 15 (K3), PSII site A- 5 (C1)

Trade Name	Company	Common Name of Individual Herbicides [percent ai (liquid or dry) or lbs ai/gal (liquid) or lb ai/ lb product (dry) represented in parentheses]	Site/Mode of action of herbicides represented in this product†^
Brash	Agriliance	dicamba (1 lb or 10.3%) + 2,4-D (2.87 lbs or 29.6%)	auxin mimic- 1 (O)
Brawl II ATZ	Tenkoz	atrazine (3.1 lbs or 33.7%- atrazine + related triazines) + s-metolachlor (2.4 lbs or 26.1%)	Inhibitor of very long chain fatty acid biosynthesis 15- (K3), PSII site A- 5 (C1)
Brawn	Syngenta	atrazine (3.1 lbs or 33.7%- atrazine + related triazines) + s-metolachlor (2.4 lbs or 26.1%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Breakfree ATZ	DuPont	acetochlor (3 lbs or 32.6%) + atrazine (2.25 lbs or 24.4%- atrazine + related triazines)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Breakfree ATZ Lite	DuPont	acetochlor (4 lbs or 43.4%) + atrazine (1.5 lbs or 16.3%- atrazine + related triazines)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Broadstrike + Dual	Syngenta (Novartis)	flumetsulam (0.2 lb) + metolachlor (7.47 lb)	ALS-inhibitor- 2 (B), Inhibitor of very long chain fatty acid biosynthesis- 15 (K3)
Broadstrike SF + Dual	Syngenta (Novartis)	flumetsulam (0.25 lb) + metolachlor (7.47 lb)	ALS-inhibitor- 2 (B), Inhibitor of very long chain fatty acid biosynthesis- 15 (K3)
Broadstrike + Treflan	Dow	flumetsulam (0.25 lb) + trifluralin (3.4 lb)	ALS-inhibitor- 2 (B), Inhibitor of microtubule assembly- 3 (K1)
Bromac	UAP-Loveland	bromoxynil (2 lbs or 21.8%) + MCPA (2 lbs or 21.8%)	PSII site B- 6 (C3), auxin mimic- 1 (O)
Bromac Advanced	UAP-Loveland	bromoxynil (2.5 lbs) + MCPA (2.5 lbs)	PSII site B- 6 (C3), auxin mimic- 1 (O)
Bromacil/Diuron 40/40	Alligare	bromacil (40%) + diuron (40%)	PSII site A- 5 (C1), PSII site A2- 7 (C2)
Bromox/MCPA	Micro Flo	bromoxynil (2 lbs) + MCPA (2 lbs)	PSII site B- 6 (C3), auxin mimic- 1 (O)
Bronate	Bayer	bromoxynil (2 lbs or 21.8%) + MCPA (2 lbs or 21.8%)	PSII site B- 6 (C3), auxin mimic- 1 (O)
Bronate Advanced	Bayer	bromoxynil (2.5 lbs) + MCPA (2.5 lbs)	PSII site B- 6 (C3), auxin mimic- 1 (O)
Bronco	Monsanto	alachlor (2.6 lbs) + glyphosate (1.04 lbs acid)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), EPSP synthase- 9 (G)
Brox-M	Albaugh/Agri Star	bromoxynil (2 lbs or 21.8%) + MCPA (2 lbs or 21.8%)	PSII site B- 6 (C3), auxin mimic- 1 (O)
Brox-M Ultra	Albaugh/Agri Star	bromoxynil (2.5 lbs) + MCPA (2.5 lbs)	PSII site B- 6 (C3), auxin mimic- 1 (O)
Brozine	UAP-Loveland	bromoxynil (1 lb or 10.81%) + atrazine (2 lbs or 21.62%)	PSII site B- 6 (C3), PSII site A- 5 (C1)
Brushbuster	BASF	2,4-D (1.9 lbs) + dicamba (1 lb)	auxin mimic- 1 (O)
Brush Buster Woody Plant	Lawn & Garden Products	2,4-D (0.78 lb or 10.6%) + dichlorprop-p (0.4 lb or 5.4%)	auxin mimic- 1 (O)
Brush Killer	PBI Gordon	2,4-D (1.98 lbs or 21.54%) + mecoprop-p (0.53 lb or 5.73%) + dicamba (0.21 lb or 2.29%)	auxin mimic- 1 (O)
Brush killer 2-2	Dow	2,4-D (34.7% of its 2-ethylhexyl ester) + 2,4,5-T (33.1% of its 2-ethylhexyl ester)	auxin mimic- 1 (O)
Brush Killer Concentrate	Spectrum Group/ Spectracide	2,4-D (0.51 lb or 6.46%) + dichlorprop-p (0.24 lb or 3.23%) + dicamba (0.13 lb or 1.65%)	auxin mimic- 1 (O)
Brushmaster	PBI Gordon	dicamba (0.24 lb or 3.01%) + 2,4-D (1.02 lbs or 12.5%) + dichlorprop-p (0.51 lb or 6.25%)	auxin mimic- 1 (O)

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Brush-no-more	PBI Gordon	2,4-D (0.51 lb) + dicamba (0.13 lb) + dichlorprop-p (0.51 lb)	auxin mimic- 1 (O)
Brush-Rhap	Helena	dicamba (1.8 lbs or 18.28%) + 2,4-D (2.4 lbs or 24.62%)	auxin mimic- 1 (O)
Buckle	Gowan	triallate (10%) + trifluralin (3%)	Inhibitor of lipid synthesis- 8 (N), Inhibitor of microtubule assembly- 3 (K1)
Buctril + Atrazine	Bayer	bromoxynil (1 lb) + atrazine (2 lb)	PSII site B- 6 (C3), PSII site A- 5 (C1)
Bullet	Monsanto	alachlor (2.5 lbs or 25.4%) + atrazine (1.5 lbs or 15.3%- atrazine + related triazines)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Cadence ATZ	UAP-Loveland	acetochlor (3 lbs or 32.6%) + atrazine (2.25 lbs or 24.4%- atrazine + related triazines)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Cadence ATZ Lite	UAP-Loveland	acetochlor (4 lbs or 43.4%) + atrazine (1.5 lbs or 16.3%- atrazine + related triazines)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Camix	Syngenta	s-metolachlor (3.34 lbs or 36.8%) + mesotrione (0.33 lb or 3.68%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), HPPD inhibitor- 27 (F2)
Campaign	Monsanto	glyphosate (1.2 lbs or 12.9% as its isopropylamine salt) + 2,4-D (1.9 lbs or 20.6%)	EPSP synthase- 9 (G), auxin mimic- 1 (O)
Cannon	Monsanto	alachlor (2.5 lbs) + trifluralin (0.5 lb)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), Inhibitor of microtubule assembly- 3 (K1)
Canon broadleaf weed killer	Miller & Sons/ Canon Chemical	2,4-D (3.4% as its dimethylamine salt) + MCPP (4.3% as its diethanolamine salt)	auxin mimic- 1 (O)
Canopy	DuPont	chlorimuron (10.7%) + metribuzin (64.3%)	ALS-inhibitor- 2 (B), PSII site A- 5 (C1)
Canopy XL	DuPont	chlorimuron (9.4%) + sulfentrazone (46.9%)	ALS-inhibitor- 2 (B), PPO inhibitor- 14 (E)
Canopy EX	DuPont	chlorimuron (22.7%) + tribenuron (6.8%)	ALS-inhibitors- 2 (B)
Canvas	DuPont	metsulfuron (15%) + thifensulfuron (37.5%) + tribenuron (18.75%)	ALS-inhibitors- 2 (B)
Celebrity	BASF	dicamba (69.3% as its sodium salt) + nicosulfuron (7.5%)	auxin mimic- 1 (O), ALS-inhibitor- 2 (B)
Celebrity Plus	BASF	dicamba (42.4%) + nicosulfuron (10.6%) + diflufenzopyr (17%)	auxin mimic- 1 (O), ALS-inhibitor- 2 (B) auxin transport inhibitor- 19 (P)
Charger MAX ATZ	Agriliance	atrazine (3.1 lbs or 33.7%- atrazine + related triazines) + s-metolachlor (2.4 lbs or 26.1%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Charger MAX ATZ Lite	Agriliance	atrazine (2.67 lbs or 28.7%- atrazine + related triazines) + s-metolachlor (3.33 lbs or 35.8%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Chaser	Verdicon/UAP	triclopyr (1 lb or 16.5% as its butoxyethyl ester)+ 2,4-D (2 lbs or 34.4% as its butoxyethyl ester)	auxin mimic- 1 (O)
Chaser 2	Verdicon/UAP	triclopyr (1.07 lbs) + 2,4-D (2.78 lbs)	auxin mimic- 1 (O)
Chaser Ultra	Verdicon/UAP	MCPA (3.2 lbs) + dicamba (0.18 lb) + dichlorprop-p (0.64 lb)	auxin mimic- 1 (O)
Chaser Ultra 2	Verdicon/UAP	MCPA (3.2 lbs 33.97%) + fluroxypyr (0.32 lb or 3.4%) + dichlorprop-p (0.64 lb or 6.79%)	auxin mimic- 1 (O)

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Cheyenne	Bayer	fenoxaprop (0.79 lb) + MCPA (4 lbs)	ACCase inhibitor- 1 (A), auxin mimic- 1 (O)
Cimarron Max	DuPont	**Part A:** metsulfuron (60%) **Part B:** dicamba (1 lb or 10.3%) + 2,4-D (2.87 lbs or 29.6%)	ALS-inhibitors- 2 (B), auxin mimic- 1 (O)
Cimarron Plus	DuPont	metsulfuron (48%) + chlorsulfuron (15%)	ALS-inhibitors- 2 (B)
Cimarron X-tra	DuPont	metsulfuron (30%) + chlorsulfuron (37.5%)	ALS-inhibitors- 2 (B)
Cinch ATZ	DuPont	atrazine (3.1 lbs or 33.7%- atrazine + related triazines) + s-metolachlor (2.4 lbs or 26.1%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Cinch ATZ Lite	DuPont	atrazine (2.67 lbs or 28.7%- atrazine + related triazines) + s-metolachlor (3.33 lbs or 35.8%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Clarion	DuPont	nicosulfuron (37.5%) + rimsulfuron (37.5%)	ALS-inhibitors- 2 (B)
Cleanout Brush & Stump Spray	PBI Gordon	2,4-D (0.49 lb or 6.46%) + mecoprop-p (0.24 lb or 3.23%) + dicamba (0.12 lb or 1.65%)	auxin mimic- 1 (O)
CleanWave	Dow	aminopyralid (0.085 lbs or 1%) + fluroxypyr (1.2 lbs or 14.03%)	auxin mimic- 1 (O)
Clearmax	BASF	**Part A:** imazamox (1 lb) + **Part B:** MCPA (3.7 lbs)	ALS-inhibitors- 2 (B), auxin mimic- 1 (O)
Clearpath	BASF	imazethapyr (13.02%) + quinclorac (61.98%)	ALS-inhibitors- 2 (B), auxin mimic- 1 (O)
Colt	UAP-Loveland	clopyralid (0.75 lb or 8.6%) + fluroxypyr (0.75 lb or 8.6%)	auxin mimic- 1 (O)
Colt AS	UAP-Loveland	clopyralid (0.75 lb or 8.6%) + fluroxypyr (0.75 lb or 8.6%)	auxin mimic- 1 (O)
Conclude Ultra	BASF	bentazon (1.69 lbs) + acifluorfen (0.84 lb) + sethoxydim (1.29 lbs)	PSII site B- 6 (C3), PPO inhibitor- 14 (E), ACCase inhibitor- 1 (A)
Conclude Xact	BASF	bentazon (2.67 lbs) + acifluorfen (1.33 lbs) + sethoxydim (2 lbs)	PSII site B- 6 (C3), PPO inhibitor- 14 (E), ACCase inhibitor- 1 (A)
Conclude Xtra B	BASF	bentazon (2.67 lbs) + acifluorfen (1.33 lbs)	PSII site B- 6 (C3), PPO inhibitor- 14 (E)
Confidence Xtra	Agriliance	acetochlor (4.3 lbs or 46.3%) + atrazine (1.7 lbs or 18.3%- atrazine + related triazines)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Confidence Xtra 5.6L	Agriliance	acetochlor (3.1 lbs or 33.4%) + atrazine (2.5 lbs or 26.9%- atrazine + related triazines)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Confront	Dow	clopyralid (0.75 lb or 7.9%) + triclopyr (2.25 lbs or 23.7%)	auxin mimic- 1 (O)
Contour	BASF	imazethapyr (0.38 lb) + atrazine (3 lbs- atrazine + related triazines)	ALS-inhibitor- 2 (B), PSII site A- 5 (C1)
Cool Power	Nufarm	dicamba (0.3 lb and 3.6%) + MCPA (3 lbs or 36%) + triclopyr (0.3 lb and 3.6%)	auxin mimic- 1 (O)
Commando	Albaugh/Agri Star	clopyralid (0.38 lb or 3.9%) + 2,4-D (2 lbs or 20.9%)	auxin mimic- 1 (O)
Commando M	Albaugh/Agri Star	clopyralid (0.42 lb or 5%) + MCPA (2.35 lbs or 27.8%)	auxin mimic- 1 (O)
Contour	BASF	imazethapyr (0.38 lb) + atrazine (3 lbs)	ALS-inhibitors- 2 (B), PSII site A- 5 (C1)
CoStarr	Albaugh/Agri Star	glyphosate (1.1 lbs) + dicamba (0.5 lb)	EPSP synthase- 9 (G), auxin mimic- 1 (O)
Crabgrass Preventer with Team	Green Light Co.	benefin (1.33%) + trifluralin (0.67%)	Inhibitors of microtubule assembly- 3 (K1)

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Crossbow	Dow, other	triclopyr (1 lb or 11.9%) + 2,4-D (2 lbs or 23.7%)	auxin mimic- 1 (O)
Crossbow L	UAP-Loveland	triclopyr (1 lb or 11.9%) + 2,4-D (2 lbs or 23.7%)	auxin mimic- 1 (O)
Crossroad	Albaugh/Agri Star	triclopyr (1 lb or 11.9%) + 2,4-D (2 lbs or 23.7%)	auxin mimic- 1 (O)
Curtail	Dow	clopyralid (0.38 lb or 3.9%) + 2,4-D (2 lbs or 20.9%)	auxin mimic- 1 (O)
Curtail M	Dow	clopyralid (0.42 lb or 5%) + MCPA (2.35 lbs or 27.8%)	auxin mimic- 1 (O)
Cutback	Nufarm	clopyralid (0.38 lb or 3.9%) + 2,4-D (2 lbs or 20.9%)	auxin mimic- 1 (O)
Cutback M	Nufarm	clopyralid (0.42 lb or 5%) + MCPA (2.35 lbs or 27.8%)	auxin mimic- 1 (O)
Dakota	Bayer	fenoxaprop (0.234 lb) + MCPA (2.8 lbs)	ACCase inhibitor- 1 (A), auxin mimic- 1 (O)
Degree Xtra	Monsanto	acetochlor (2.70 lbs or 29%) + atrazine (1.34 lbs or 14.5%-atrazine + related triazines)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Derby	Syngenta	metolachlor (4%) + simazine (1%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
DiBro 2 + 2	Nufarm/Riverdale	diuron (2%) + bromacil (2%)	PSII site A2- 7 (C2), PSII site A- 5 (C1)
DiBro 4 + 2	Nufarm/Riverdale	diuron (4%) + bromacil (2%)	PSII site A2- 7 (C2), PSII site A- 5 (C1)
Dissolve premium granular weed killer	Nufarm	MCPP (0.73% as its dimethylamine salt) + 2,4-D (1.4% as its dimethylamine salt) + 2,4-DP (0.71% as its dimethylamine salt)	auxin mimic- 1 (O)
Distinct	BASF	dicamba (50%) + diflufenzopyr (20%)	auxin mimic- 1 (O), auxin transport inhibitor- 19 (P)
Domain	Bayer	flufenacet (24%) + metribuzin (36%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Double O E-Pro	Etigra	oxyfluorfen (2%) + oryzalin (1%)	PPO inhibitor- 14 (E), Inhibitor of microtubule assembly- 3 (K1)
DoublePlay	Syngenta	acetochlor (1.4 lbs or 16.9%) + EPTC (5.6 lbs or 67.8%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), Inhibitor of lipid synthesis- 8 (N)
Double Team	MANA	acetochlor (3.5 lbs or 38.2%) + atrazine (1.78 lbs or 19.42%-atrazine + related triazines)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Double Up B+D	Helena	bromoxynil (2 lbs and 20.69%) + 2,4-D (1.9 lbs and 20.69%)	PSII site B- 6 (C3), auxin mimic- 1 (O)
Duet 60DF	RiceCo.	propanil (0.6 lb or 60%) + bensulfuron (2.1 grams or 0.46%)	ALS-inhibitor- 2 (B), PSII site A2- 7 (C2)
Duet CA	RiceCo.	propanil (4 lbs or 41.2%) + bensulfuron (14 grams or 0.32%)	ALS-inhibitor- 2 (B), PSII site A2- 7 (C2)
Echelon	FMC	sulfentrazone (13.6%) + prodiamine (27.3%)	PPO inhibitor- 14 (E), Inhibitor of microtubule assembly- 3 (K1)
EndRun	Helena	2,4-D (2.38 lbs or 25.38%) + mecoprop-P (0.63 lb or 6.75%) + dicamba (0.21 lb or 2.3%)	auxin mimic- 1 (O)
Enlite	DuPont	chlorimuron (2.85%) + thifensulfuron (8.8%) + flumioxazin (36.21%)	PPO inhibitor- 14 (E), ALS-inhibitor- 2 (B)
Envert 171	Bayer	2,4-D (0.95 lb) + dichlorprop-p (1.125 lbs)	auxin mimic- 1 (O)

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Envive	DuPont	chlorimuron (9.2%) + thifensulfuron (2.9%) + flumioxazin (29.2%)	PPO inhibitor- 14 (E), ALS-inhibitor- 2 (B)
Epic	Bayer	flufenacet (48%) + isoxaflutole (10%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), HPPD inhibitor- 27 (F2)
Equip	Bayer	foramsulfuron (30%) + iodosulfuron (2%)	ALS-inhibitor- 2 (B)
Escalade	Nufarm/Riverdale	2,4-D (3.2 lbs or 32.83%) + fluroxypyr (0.8 lb or 8.21%) + dicamba (0.4 lb or 4.1%)	auxin mimic- 1 (O)
Escalade 2	Nufarm/Riverdale	2,4-D (3.2 lbs or 32.83%) + fluroxypyr (0.4 lb or 4.1%) + dicamba (0.4 lb or 4.1%)	auxin mimic- 1 (O)
Escalade Low Odor	Nufarm/Riverdale	2,4-D (3.2 lbs or 27.12%) + fluroxypyr (0.8 lb or 5.09%) + dicamba (0.4 lb or 3.39%)	auxin mimic- 1 (O)
Escalade Weed and Feed MC	Nufarm/Riverdale	2,4-D (69.75% as its 2-methylhexyl ester) + fluroxypyr (16.64% as its 1-methylheptyl ester) + dicamba (5.78% acid)	auxin mimic- 1 (O)
Establish ATZ	Tenkoz	dimethenamid-P (1.7 lbs or 18.2%) + atrazine (3.3 lbs or 35.3%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Establish Lite	Tenkoz	dimethenamid-P (2.25 lbs or 24.1%) + atrazine (2.75 lbs or 29.5%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Event	BASF	imazapyr (0.64%) + imazethapyr (17.26%)	ALS-inhibitors- 2 (B)
Exceed	Syngenta	primisulfuron (28.5%) + prosulfuron (28.5%)	ALS-inhibitors- 2 (B)
Expert	Syngenta	s-metolachlor (1.74 lbs or 18.6%) + atrazine (2.14 or 22.9%-atrazine + related triazines) + glyphosate (1 lb or 10.8% as its isopropylamine salt)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), EPSP synthase- 9 (G), PSII site A- 5 (C1)
Extreme	BASF	glyphosate (2 lbs or 22% as its isopropylamine salt) + imazethapyr (0.17 lbs or 1.8%)	EPSP synthase- 9 (G), ALS-inhibitors- 2 (B)
Fallow Master	Monsanto	glyphosate (1.6 lbs) + dicamba (0.4 lb or 4.1%)	EPSP synthase- 9 (G), auxin mimic- 1 (O)
Fallow Star	Albaugh/Agri Star	glyphosate (1.1 lbs) + dicamba (0.5 lb)	EPSP synthase- 9 (G), auxin mimic- 1 (O)
Field Master	Monsanto	acetochlor (2 lbs or 21.6%) + atrazine (1.5 lbs or 16.2%-atrazine + related triazines) + glyphosate (0.56 lbs acid or 0.75 lbs or 8.2% of its isopropylamine salt)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), EPSP synthase- 9 (G), PSII site A- 5 (C1)
Finesse	DuPont	chlorsulfuron (62.5%) + metsulfuron (12.5%)	ALS-inhibitors- 2 (B)
Finesse Grass and Broadleaf	DuPont	chlorsulfuron (25%) + flucarbazone (44%)	ALS-inhibitors- 2 (B)
Fire Power	Monsanto	glyphosate (40% as its isopropylamine salt) + oxyfluorfen (2.5%)	EPSP synthase- 9 (G), PPO inhibitor- 14 (E)
FirstShot SG	DuPont	thifensulfuron (25%) + tribenuron (25%)	ALS-inhibitors- 2 (B)
ForeFront R&P	Dow	aminopyralid (0.33 lb or 3.4%) + 2,4-D (2.67 lbs or 27.2%)	auxin mimic- 1 (O)
Four Power Plus	Verdicon/UAP	2,4-D (4 lbs or 40%) + dicamba (0.5 lb or 5%)	auxin mimic- 1 (O)
Freedom	Monsanto	alachlor (2.67 lbs or 31.7%) + trifluralin (0.33 lb or 3.9%)	Inhibitor of very long chain fatty acid

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			biosynthesis- 15 (K3), Inhibitor of microtubule assembly- 3 (K1)
Frontrow	Dow	**Part A:** cloransulam-methyl (0.84 lb or 84%) + **Part B:** flumetsulam (0.8 lb or 80%)	ALS-inhibitors- 2 (B)
Fuego	Syngenta	**Part A:** dicamba (4 lbs) + **Part B:** triasulfuron (75%)	auxin mimic- 1 (O), ALS-inhibitors- 2 (B)
FulTime	Dow	acetochlor (2.4 lbs or 24.8%) + atrazine (1.6 lbs or 16.6%-atrazine + related triazines)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Fusion	Syngenta	fenoxaprop-P-ethyl (0.56 lb or 6.76%) + fluazifop-P-butyl (2 lbs or 24.15%)	ACCase inhibitors- 1 (A)
Galaxy	BASF	bentazon (3 lbs or 33.4%) + acifluorfen (0.67 lb or 6.8%)	PSII site B- 6 (C3), PPO inhibitor- 14 (E)
Galigan Slapshot	MANA	glyphosate (1 lb acid or 1.33 lbs or 14.2% as its isopropylamine salt) + oxyfluorfen (2 lbs or 21.1%)	EPSP synthase- 9 (G), PPO inhibitor- 14 (E)
Gangster	Valent	**Part V:** flumioxazin (51%) + **Part FR:** cloransulam-methyl (84%)	PPO inhibitor- 14 (E), ALS-inhibitors- 2 (B)
GlyKamba	Nufarm	glyphosate (1.6 lbs acid or 2.2 lbs or 23.3% as its isopropylamine salt) + dicamba (0.4 lb or 4.1%)	EPSP synthase- 9 (G), auxin mimic- 1 (O)
GlyMix MT	Dow	glyphosate (3 lbs) + 2,4-D (0.32 lb)	EPSP synthase- 9 (G), auxin mimic- 1 (O)
G-Max Lite	BASF	dimethenamid-P (2.25 lbs or 24.1%) + atrazine (2.75 lbs or 29.5%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Grazon P+D	Dow	picloram (0.54 lb or 5.7%) + 2,4-D (2 lbs or 21.2%)	auxin mimic- 1 (O)
GroundClear Complete Vegetation Killer Concentrate	Ortho	glyphosate (5%) + imazapyr (0.08%)	EPSP synthase- 9 (G), ALS-inhibitor- 2 (B)
GroundClear Complete Vegetation Killer Ready-to-use	Ortho	glyphosate (1%) + imazapyr (0.016%)	EPSP synthase- 9 (G), ALS-inhibitor- 2 (B)
Guardsman	BASF	dimethenamid (2.33 lbs or 24.8%) + atrazine (2.67 lbs or 28.4%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Guardsman Max	BASF	dimethenamid-P (1.7 lbs or 18.2%) + atrazine (3.3 lbs or 35.3%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Gunslinger	Albaugh/Agri Star	picloram (0.54 lb or 5.7%) + 2,4-D (2 lbs or 21.2%)	auxin mimic- 1 (O)
Gunslinger IVM	Albaugh/Agri Star	picloram (0.54 lb or 5.7%) + 2,4-D (2 lbs or 21.2%)	auxin mimic- 1 (O)
Halex GT	Syngenta	s-metolachlor (2.09 lbs or 20.5%) + glyphosate (2.09 lbs or 20.5%) + mesotrione (0.209 lb or 2.05%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), EPSP synthase- 9 (G), HPPD inhibitor- 27 (F2)
Harmony Extra	DuPont	thifensulfuron (50%) + tribenuron (25%)	ALS-inhibitors- 2 (B)

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Harness Xtra	Monsanto	acetochlor (4.3 lbs or 46.3%) + atrazine (1.7 lbs or 18.3%-atrazine + related triazines)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Harness Xtra 5.6L	Monsanto	acetochlor (3.1 lbs or 33.4%) + atrazine (2.5 lbs or 26.9%-atrazine + related triazines)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
HiredHand P+D	Dow	picloram (0.54 lb or 5.7%) + 2,4-D (2 lbs or 21.2%)	auxin mimic- 1 (O)
Horizon 2000	Bayer	fenoxaprop-P-ethyl (0.56 lb or 6.76%) + fluazifop-P-butyl (2 lbs or 24.15%)	ACCase inhibitors- 1 (A)
Hornet	Dow	clopyralid (62,5%) + flumetsulam (23.1%)	auxin mimic- 1 (O), ALS-inhibitors- 2 (B)
Horsepower	Nufarm	MCPA (3.8 lbs or 40%) + triclopyr (0.38 lb or 4%) + dicamba (0.38 lb or 4%)	auxin mimic- 1 (O)
Huskie	Bayer	pyrasulfatole (3.3%) + bromoxynil (13.4% as its octanoate ester + 12.9% as it heptanoate ester)	HPPD inhibitor- 27 (F2), PSII site B- 6 (C3)
Imperium	Gowan	acetochlor (1.4 lbs or 16.9%) + EPTC (5.6 lbs or 67.8%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), Inhibitor of lipid synthesis- 8 (N)
Journey	BASF	glyphosate (1.5 lbs) + imazapic (0.75 lb or 8.13%)	EPSP synthase- 9 (G), ALS-inhibitors- 2 (B)
KambaMaster	Nufarm	dicamba (1 lb) + 2,4-D (2.87 lbs)	auxin mimic- 1 (O)
Kansel Plus	Scotts	oxadiazon (2%) + pendimethalin (1.25%)	PPO inhibitor- 14 (E), Inhibitor of microtubule assembly- 3 (K1)
Keystone	Dow	acetochlor (3 lbs or 32.6%) + atrazine (2.25 lbs or 24.4%-atrazine + related triazines)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Keystone LA	Dow	acetochlor (4 lbs or 43.4%) + atrazine (1.5 lbs or 16.3%-atrazine + related triazines)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Krovar I DF	DuPont	bromacil (40%) + diuron (40%)	PSII site A- 5 (C1), PSII site A2- 7 (C2)
Laddok S-12	BASF	bentazon (2.5 lbs or 27%) + atrazine (2.5 lbs or 25%-atrazine + related triazines)	PSII site B- 6 (C3), PSII site A- 5 (C1)
Landmark MP or XP	DuPont	chlorsulfuron (25%) + sulfometuron (50%)	ALS-inhibitors- 2 (B)
Landmark II MP	DuPont	chlorsulfuron (18.75%) + sulfometuron (56.25%)	ALS-inhibitors- 2 (B)
Landmaster	Monsanto	glyphosate (0.9 lbs acid / 1.2 lbs or 12.9% as its isopropylamine salt) + 2,4-D (1.5 lbs acid / 1.9 lbs or 20.6% as its isopropylamine salt)	EPSP synthase- 9 (G), auxin mimic- 1 (O)
Landmaster II	Monsanto	glyphosate (0.9 lbs acid/ 1.2 lbs or 13.3% as its isopropylamine salt) + 2,4-D (0.8 lb acid / 1 lb or 11.1% as its isopropylamine salt)	EPSP synthase- 9 (G), auxin mimic- 1 (O)
Landmaster BW	Monsanto	glyphosate (0.9 lbs acid / 1.2 lbs or 12.9% as its isopropylamine salt) + 2,4-D (1.5 lbs acid / 1.9 lbs or 20.6% as its isopropylamine salt)	EPSP synthase- 9 (G), auxin mimic- 1 (O)
Lariat	Monsanto	alachlor (2.5 lbs or 27.2%) + atrazine (1.5 lbs or 16.3%-	Inhibitor of very long chain fatty acid

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		atrazine + related triazines)	biosynthesis- 15 (K3), PSII site A- 5 (C1)
Layby Pro	DuPont	linuron (2 lbs or 20.3%) + diuron (2 lbs or 20%)	PSII site A2- 7 (C2)
Leadoff	DuPont	dimethenamid (2.33 lbs or 24.8%) + atrazine (2.67 lbs or 28.4%- atrazine + related triazines)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Lexar	Syngenta	s-metolachlor (1.74 lbs or 19%) + atrazine (1.74 lbs or 19%- atrazine + related triazines) + mesotrione (0.224 lbs or 2.44%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1), HPPD inhibitor- 27 (F2)
Liberator 600	Atco International	bromacil (0.98%) + 2,4-D (1.09%)	PSII site A- 5 (C1), auxin mimic- 1 (O)
Liberty ATZ	Bayer	atrazine (3.3 lbs- atrazine + related triazines) + glufosinate (1 lb)	PSII site A- 5 (C1), Inhibitor of glutamine synthetase- 10 (H)
Lightning	BASF	imazapyr (17.5%) + imazethapyr (52.5%)	ALS inhibitors- 2 (B)
Lineage Clearstand	DuPont	imazapyr (63.2%) + metsulfuron (9.5%)	ALS inhibitors- 2 (B)
Lineage HWC	DuPont	imazapyr (37.5%) + metsulfuron (7.5%) + sulfometuron (28.1%)	ALS inhibitors- 2 (B)
Lineage Prep	DuPont	imazapyr (54.5%) + metsulfuron (4.1%) + sulfometuron (15.3%)	ALS inhibitors- 2 (B)
Lumax	Syngenta	s-metolachlor (2.68 lbs or 29.4%) + atrazine (1 lb or 11%- atrazine + related triazines) + mesotrione (0.268 lbs or 2.94%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1), HPPD inhibitor- 27 (F2)
Maestro D	Nufarm	bromoxynil (2 lbs or 20.69%) + 2,4-D (1.9 lbs or 20.69%)	PSII site B- 6 (C3), auxin mimic- 1 (O)
Maestro MA	Nufarm	bromoxynil (2 lbs or 21.8%) + MCPA (2 lbs or 21.8%)	PSII site B- 6 (C3), auxin mimic- 1 (O)
Marksman	BASF	atrazine (2.1 lbs or 22.23%) + dicamba (1.1 lbs or 11.45%)	PSII site A- 5 (C1), auxin mimic- 1 (O)
Mec Amine-D Turf Herbicide	Verdicon	2,4-D (2.44 lbs or 25.38%) + mecoprop-p (0.65 lb or 6.75%) + dicamba (0.22 lb or 2.3%)	auxin mimic- 1 (O)
Medal II AT	Syngenta	s-metolachlor (2.4 lbs or 26.1%) + atrazine (3.1 lbs or 33.7%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Milestone VM Plus	Dow	aminopyralid (0.1 lb or 1.15%) + triclopyr (1 lb or 11.63%)	auxin mimic- 1 (O)
Millennium Ultra 2	Lesco	clopyralid (0.183 lb or 1.93%) + dicamba (0.375 lb or 3.86%) + 2,4-D (3 lbs or 31%)	auxin mimic- 1 (O)
Misty 2 Plus 2	Amrep	bromacil (2%) + diuron (2%)	PSII site A- 5 (C1), PSII site A2- 7 (C2)
Momentum Premium	Lesco	triclopyr (0.27 lb) + clopyralid (0.13 lb) r + 2,4-D (2.67 lbs)	auxin mimic- 1 (O)
Momentum FX	Lesco	triclopyr (0.229 lb) + fluroxypyr (0.571 lb) + 2,4-D (2.286 lbs)	auxin mimic- 1 (O)
Momentum FX2	Lesco	triclopyr (0.263 lb or 2.77%) + fluroxypyr (0.278 lb or 2.92%) + 2,4-D (2.254 lbs or 23.7%)	auxin mimic- 1 (O)
Momentum Force Weed and Feed	Lesco	2,4-D (0.955%) + mecoprop-P (0.319%) + dicamba (0.08%)	auxin mimic- 1 (O)
Moxy+Atrazine	Agriliance	bromoxynil (1 lb) + atrazine (2 lbs)	PSII site B- 6 (C3), PSII site A- 5 (C1)
NorthStar	Syngenta	dicamba (39.9%) + primisulfuron (7.5%)	auxin mimic- 1 (O), ALS-inhibitor- 2 (B)

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Oasis	BASF	2,4-D (58.2% as its 2-ethylhexyl ester) + imazapic (19.4%)	auxin mimic- 1 (O), ALS-inhibitor- 2 (B)
OH2 (Ornamental Herbicide)	Scotts	oxyfluorfen (2%) + pendimethalin (1%)	PPO inhibitor- 14 (E), Inhibitor of microtubule assembly- 3 (K1)
Olympus Flex	Bayer	propoxycarbazone-sodium (6.75%) + mesosulfuron-methyl (4.5%)	ALS-inhibitors- 2 (B)
OneStep	BASF	imazapyr (0.637 lb or 6.82%) + glyphosate (1.531 lbs or 16.4%)	ALS-inhibitor- 2 (B), EPSP synthase- 9 (G)
One-Step Non-Selective Weed Killer	Momar	bromacil (0.98%) + 2,4-D (1.09%)	PSII site A- 5 (C1), auxin mimic- 1 (O)
OpTill	BASF	dicamba (1 lb) + dimethenamid (5 lbs)	auxin mimic- 1 (O), Inhibitor of very long chain fatty acid biosynthesis- 15 (K3)
Ornamental Herbicide II	Scotts	oxyfluorfen (2%) + pendimethalin (1%)	PPO inhibitor- 14 (E), Inhibitor of microtubule assembly- 3 (K1)
Oustar	DuPont	hexazinone (63.2%) + sulfometuron (11.8%)	PSII site A- 5 (C1), ALS-inhibitor- 2 (B)
Oust Extra	DuPont	metsulfuron (15%) + sulfometuron (56.25%)	ALS-inhibitors- 2 (B)
Outlaw	Albaugh/Agri Star	dicamba (1.09 lbs or 12.18%) + 2,4-D (1.45 lbs or 16.1%)	auxin mimic- 1 (O)
Overdrive	BASF	dicamba (0.5 lb or 50%) + diflufenzopyr (0.2 lb or 20%)	auxin mimic- 1 (O), auxin transport inhibitor- 19 (P)
Overtime ATZ	Helena	acetochlor (32.6%) + atrazine (24.4%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Overtime ATZ Lite	Helena	acetochlor (43.4%) + atrazine (16.3%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Parallel Plus	MANA	metolachlor (2.7 lbs or 28.9%) + atrazine (2.8 lbs or 30.5%-atrazine + related triazines)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
PastureGard	Dow	triclopyr (1.5 lbs or 17.97%) + fluroxypyr (0.5 lb or 5.99%)	auxin mimic- 1 (O)
PastureMaster	Nufarm	2,4-D (1.9 lbs) + dicamba (1 lb)	auxin mimic- 1 (O)
Pasture MD	Nufarm	2,4-D (17.9% as its diethylamine salt) + dicamba (6.2% as its dimethylamine salt) + metsulfuron (30%)	auxin mimic- 1 (O), ALS-inhibitor- 2 (B)
Patron 170	Nufarm/Riverdale	2,4-D (1.71 lbs or 21.3%) + dichlorprop-p (0.87 lb or 10.9%)	auxin mimic- 1 (O)
Pathway	Dow	picloram (3%) + 2,4-D (11.2%)	auxin mimic- 1 (O)
PD 2	Albaugh/Agri Star	picloram (0.5 lb or 5.7%) + 2,4-D (2 lbs or 21.2%) + dicamba (0.5 lb or 5.7%)	auxin mimic- 1 (O)
Perdition Granular	Drummond	bromacil (4%) + diuron (2%)	PSII site A- 5 (C1), PSII site A2- 7 (C2)
Phenaban 801	PBI Gordon	2,4-D (3.06 lbs) + dicamba (0.4 lb)	auxin mimic- 1 (O)
Phenomec	PBI Gordon	2,4-D (1 lb) + mecoprop (2 lb)	auxin mimic- 1 (O)
Phos Free Weed & Feed 5M	Spectrum Group/ Vigoro	2,4-D (0.64%) + mecoprop-p (0.16%) + dicamba (0.03%)	auxin mimic- 1 (O)

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Power Zone	PBI Gordon	carfentrazone (0.04 lb or 0.48%) + dicamba (0.22 lb or 2.69%) + mecoprop-p (0.44 lb or 5.39%) + MCPA (2.21 lbs or 26.92%)	PPO inhibitor- 14 (E), auxin mimic- 1 (O)
Pramitol 5 PS	MANA/UAP	prometon (5%) + simazine (0.76%) + sodium chlorate (39.8%) + sodium metaborate (40%)	PSII site A- 5 (C1), unknown site (Z)
PrePair	Verdicon/UAP	napropamide (4%) + oxadiazon (2%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PPO inhibitor- 14 (E)
Preen Brush Weed Killer Concentrate	Lebanon Seaboard Corp.	2,4-D (0.87 lb or 10.05%) + mecoprop-p (0.21 lb or 2.42%) + dicamba (0.1 lb or 1.11%)	auxin mimic- 1 (O)
Preen Brush Weed Killer Ready-to-use	Lebanon Seaboard Corp.	2,4-D (0.03 lb or 0.33%) + mecoprop-p (0.02 lb or 0.18%) + dicamba (0.1 lb or 0.06%)	auxin mimic- 1 (O)
Prefix	Syngenta	s-metolachlor (4.34 lb or 46.4%) + fomesafen (0.95 lb or 9.7%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PPO inhibitor- 14 (E)
Preview	DuPont	chlorimuron (6.5%)+ metribuzin (68.5%)	ALS-inhibitor- 2 (B), PSII site A- 5 (C1)
Priority	Tenkoz	carfentrazone-ethyl (50%)+ halosulfuron-methyl (12.5%)	PPO inhibitor- 14 (E), ALS-inhibitor- 2 (B)
Prompt	BASF	atrazine (17.5%) + bentazon (19.1% as its sodium salt)	PSII site A- 5 (C1), PSII site B- 6 (C3)
Prompt 5L	Micro Flo/Arysta	atrazine (2.5 lbs or 25%) + bentazon (2.5 lbs or 27% as its sodium salt)	PSII site A- 5 (C1), PSII site B- 6 (C3)
Progress	Bayer	phenmedipham (0.6 lb or 7% + desmedipham (0.6 lb or 7%) + ethofumesate (0.6 lb or 7%)	PSII site A- 5 (C1), Shoot inhibitor through inhibition of cell division- unknown site- 17 (N)
Prosecutor Swift-Acting Herbicide	Lesco	glyphosate (0.66 lb acid) + dicamba (0.03 lb)	EPSP synthase- 9 (G), auxin mimic- 1 (O)
Pursuit Plus	BASF	imazethapyr (0.2 lb or 2.24%) + pendimethalin (2.7 lbs or 30.24%)	ALS-inhibitor- 2 (B), Inhibitor of microtubule assembly- 3 (K1)
Q4	PBI Gordon	quinclorac (0.5 lb or 5.69%) + sulfentrazone (0.06 lb or 0.69%) + 2,4-D (0.88 lb or 9.98%) + dicamba (0.1 lb or 1.15%)	auxin mimic- 1 (O), PPO inhibitor- 14 (E)
QuikPro	Monsanto	diquat (0.03 lb or 2.9% as it dibromide salt) + glyphosate (1 lb or 73.3% as its ammonium salt)	Photosystem I electron diverter- 22 (D), EPSP synthase- 9 (G)
Radius	Bayer	flufenacet (3.57 lbs or 35.7%) + isoxaflutole (0.43 lbs or 4.29%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), HPPD inhibitor- 27 (F2)
Rage D-Tech	FMC	carfentrazone (0.13 lb or 1.44%) + 2,4-D (3.93 lbs)	PPO inhibitor- 14 (E), auxin mimic- 1 (O)
Ramrod/Atrazine	Monsanto	propachlor (3 lbs) + atrazine (1 lb)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Range Star	Albaugh/ Agri Star	dicamba (1 lb or 10.3%) + 2,4-D (2.87 lbs or 29.6%)	auxin mimic- 1 (O)
Rave	Syngenta	triasulfuron (8.8%) + dicamba (55%)	ALS-inhibitor- 2 (B), auxin mimic- 1 (O)
Razor Burn	Nufarm	diquat (0.11 lb active diquat or 0.21 lb or 2.1% as its	Photosystem I electron diverter- 22 (D),

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		dibromide salt) + glyphosate (3 lbs or 30.4% acid or 4 lbs or 41% as its isopropylamine salt)	EPSP synthase- 9 (G)
Ready Master ATZ	Monsanto	atrazine (2 lbs or 20.9%) + glyphosate (1.5 lbs acid or 2 lbs or 20.9% as its isopropylamine salt)	PSII site A- 5 (C1), EPSP synthase- 9 (G)
Recoil	Nufarm	glyphosate (1.58 lbs acid or 2.13 lbs or 23.03% as its isopropylamine salt) + 2,4-D (1.07 lbs or 11.38%)	EPSP synthase- 9 (G), auxin mimic- 1 (O)
Redeem R&P	Dow	clopyralid (0.75 lb or 7.9%) + triclopyr (2.25 lbs or 23.7%)	auxin mimic- 1 (O)
Refute	Albaugh/ Agri Star	clopyralid (0.75 lb or 7.9%) + triclopyr (2.25 lbs or 23.7%)	auxin mimic- 1 (O)
Regal O-O	Regal	oxadiazon (1%) + oxyfluorfen (2%)	PPO inhibitor- 14 (E)
RegalStar G or II	Regal	oxadiazon (1%) + prodiamine (0.2%)	PPO inhibitor- 14 (E), Inhibitor of microtubule assembly- 3 (K1)
Resolve SG	BASF	dicamba (56.25% or 61.9% as its sodium salt) + imazethapyr (18.7%)	auxin mimic- 1 (O), ALS-inhibitor- 2 (B)
Resolve Q	DuPont	rimsulfuron (18.4%) + thifensulfuron (4%) + isoxadifen-ethyl safener	ALS-inhibitors- 2 (B)
Require Q	DuPont	rimsulfuron (6.25%) + dicamba (52.94%) + isoxadifen-ethyl safener	ALS-inhibitor- 2 (B), auxin mimic- 1 (O)
Rezult	BASF	**Part B:** bentazon (5 lbs or 53%) **Part G:** sethoxydim (1 lb or 13%)	PSII site B- 6 (C3), ACCase inhibitor- 1 (A)
Rhino	Bayer	bromoxynil (2.5 lbs) + MCPA (1.9 lbs)	PSII site B- 6 (C3), auxin mimic- 1 (O)
Rifle D	UAP-Loveland	2,4-D (2.87 lbs or 29.6%) + dicamba (1 lb or 10.3%)	auxin mimic- 1 (O)
Rifle Plus	UAP-Loveland	atrazine (2.1 lbs or 22.23%) + dicamba (1.1 lbs or 11.45%)	PSII site A- 5 (C1), auxin mimic- 1 (O)
Rimfire	Bayer	propoxycarbazone-sodium (8.14%) + mesosulfuron-methyl (2.03%)	ALS-inhibitors- 2 (B)
Roundup Poison Ivy and Tough Brush Killer Plus Concentrate	Monsanto	glyphosate (18%) + triclopyr (2%)	EPSP synthase- 9 (G), auxin mimic- 1 (O)
Rout	Scotts	oryzalin (1%) + oxyfluorfen (2%)	Inhibitor of microtubule assembly- 3 (K1), PPO inhibitor- 14 (E)
RT Master	Monsanto	glyphosate (3 lbs) + 2,4-D (0.32 lb)	EPSP synthase- 9 (G), auxin mimic- 1 (O)
Sahara DG	BASF	diuron (62.22%) + imazapyr (7.78%)	PSII site A2- 7 (C2), ALS-inhibitor- 2 (B)
Salute	Miles/ Mobay Corp./ Bayer	metribuzin (14%) + trifluralin (28%)	PSII site A- 5 (C1), Inhibitor of microtubule assembly- 3 (K1)
Schultz Lawn Weed Killer Concentrate	Schultz	2,4-D (0.54 lb or 6.3%) + mecoprop-p (0.129 lb or 1.51%) + dicamba (0.059 lb or 0.69%)	auxin mimic- 1 (O)
Schultz Lawn Weed	Schultz	2,4-D (0.493%) + mecoprop-p (0.119%) + dicamba	auxin mimic- 1 (O)

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Killer Ready-to-use		(0.055%)	
Scorpion III	Dow	2,4-D (50%) + clopyralid (25%) + flumetsulam (9.3%)	auxin mimic- 1 (O), ALS-inhibitor- 2 (B)
Season-Long MAX Weed and Grass Killer plus Preventer Concentrate	Ortho	oxyfluorfen (1.5%) + glyphosate (8%) + diquat (0.1%)	PPO inhibitor- 14 (E), EPSP synthase- 9 (G), Photosystem I electron diverter- 22 (D)
Season-Long MAX Weed and Grass Killer plus Preventer Ready-to-use	Ortho	oxyfluorfen (0.25%) + glyphosate (0.25%)	PPO inhibitor- 14 (E), EPSP synthase- 9 (G)
Sequence	Syngenta	s-metolachlor (3 lbs or 29%) + glyphosate (2.25 lbs or 21.8%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), EPSP synthase- 9 (G)
SFM + MSM E-Pro	Etigra	sulfometuron (56.25%) + metsulfuron (15%)	ALS-inhibitors- 2 (B)
Shotgun	UAP-Loveland	atrazine (2.25 lbs or 24.74%- atrazine + related triazines) + 2,4-D (1 lb of 2,4-D or 16.58% as its 2-ethylhexyl ester)	PSII site A- 5 (C1), auxin mimic- 1 (O)
Showcase	Dow	trifluralin (2%) + isoxaben (0.25%) + oxyfluorfen (0.25%)	Inhibitor of microtubule assembly- 3 (K1), Inhibitor of cellulose synthase- 21 (L), PPO inhibitor- 14 (E)
Simazat 4L	Drexel	atrazine (2 lbs or 21.42%- atrazine + related triazines) + simazine (2 lbs or 21.41%)	PSII site A- 5 (C1)
Simazat 90DF	Drexel	atrazine (45.01%- atrazine + related triazines) + simazine (45%)	PSII site A- 5 (C1)
Snapshot 80DF	Dow	isoxaben (20%) + oryzalin (60%)	Inhibitor of cellulose synthase- 21 (L), Inhibitor of microtubule assembly- 3 (K1)
Snapshot 2.5TG	Dow	isoxaben (0.5%) + trifluralin (2%)	Inhibitor of cellulose synthase- 21 (L), Inhibitor of microtubule assembly- 3 (K1)
Sonic	Dow	cloransulam (7.9%) + sulfentrazone (62.1%)	ALS-inhibitor- 2 (B), PPO inhibitor- 14 (E)
Southern Weed Killer for Lawns Concentrate or Ready-to-spray	Bayer Advanced	2,4-D (0.311% as its dimethylamine salt) + mecoprop-p (0.075% as its dimethylamine salt) + dicamba (0.034% as its dimethylamine salt)	auxin mimic- 1 (O)
Southern Weed Killer for Lawns Concentrate or Ready-to-use	Bayer Advanced	2,4-D (6.3%) + mecoprop-p (1.51%) + dicamba (0.69%)	auxin mimic- 1 (O)
Speed Zone	PBI Gordon	carfentrazone (0.05 lb or 0.62%) + dicamba (0.14 lb or 1.71%) + mecoprop (0.48 lb or 5.88%) + 2,4-D (1.53 lbs or 18.95%)	PPO inhibitor- 14 (E), auxin mimic- 1 (O)

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Speed Zone Southern	PBI Gordon	carfentrazone (0.04 lb or 0.54%) + dicamba (0.05 lb or 0.67%) + mecoprop (0.2 lb or 2.66%) + 2,4-D (0.52 lbs or 6.96%)	PPO inhibitor- 14 (E), auxin mimic- 1 (O)
Spike Treflan 6G	Dow	tebuthiuron (2%) + trifluralin (4%)	PSII site A2- 7 (C2), Inhibitor of microtubule assembly- 3 (K1)
Sprakil SK-13 Granular Weed Killer	SSI Maxim	tebuthiuron (1%) + diuron (3%)	PSII site A2- 7 (C2)
Sprakil SK-26 Granular Weed Killer	SSI Maxim	tebuthiuron (2%) + diuron (6%)	PSII site A2- 7 (C2)
Spirit	Syngenta	primisulfuron (42.8%) + prosulfuron (14.2%)	ALS-inhibitors- 2 (B)
Squadron	BASF	imazaquin (0.33 lb or 3.84% as its monoammonium salt) + pendimethalin (2 lbs or 21.85%))	ALS-inhibitor- 2 (B), Inhibitor of microtubule assembly- 3 (K1)
Stalwart Xtra	Sipcam Agro	metolachlor (2.4 lbs or 26.1%) + atrazine (3.1 lbs or 33.7%- atrazine + related triazines)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Stampede CM	Dow / Rohm and Haas	MCPA (0.85 lbs acid or 1.4 lbs or 15% as its isooctyl ester) + propanil (3 lbs or 33%)	auxin mimic- 1 (O), PSII site A2- 7 (C2)
Staple Plus	DuPont	pyrithiobac (1.7%) + glyphosate (40.2% as its isopropylamine salt)	ALS-inhibitor- 2 (B), EPSP synthase- 9 (G)
Starane NXT	Dow	fluroxypyr (0.583 lb or 6.4%) + bromoxynil octanoate (2.33 lbs or 25.62%)	auxin mimic- 1 (O), PSII site B- 6 (C3)
Starane NXTcp	Dow	**Part A:** fluroxypyr (1.5 lbs or 18.2%) + **Part B:** bromoxynil octanoate (2 lbs or 22.9%)	auxin mimic- 1 (O), PSII site B- 6 (C3)
Starane + Esteron	Dow	fluroxypyr (0.75 lb) + 2,4-D (3 lbs)	auxin mimic- 1 (O)
Starane + MCPA	Dow	fluroxypyr (0.71 lb) + MCPA (2.84 lbs)	auxin mimic- 1 (O)
Starane + Saber	Dow/UAP-Loveland	fluroxypyr (0.5 lb or 5.5%) + 2,4-D (2 lbs or 22%)	auxin mimic- 1 (O)
Starane + Salvo	Dow/UAP-Loveland	fluroxypyr (0.75 lb or 8.4%) + 2,4-D (3 lbs or 33.6%)	auxin mimic- 1 (O)
Starane + Sword	Dow/UAP-Loveland	fluroxypyr (0.71 lb or 8.3%) + MCPA (2.84 lbs or 33.3%)	auxin mimic- 1 (O)
Status	BASF	dicamba (40%) + diflufenzopyr (16%) + isoxadifen-ethyl safener	auxin mimic- 1 (O), auxin transport inhibitor- 19 (P)
Steadfast	DuPont	nicosulfuron (50%) + rimsulfuron (25%)	ALS-inhibitors- 2 (B)
Steadfast ATZ	DuPont	atrazine (85.3%) + nicosulfuron (2.7%) + rimsulfuron (1.3%)	PSII site A- 5 (C1), ALS-inhibitors- 2 (B)
Steel	BASF	imazaquin (1.9%) + imazethapyr (1.9%) + pendimethalin (25.4%)	ALS-inhibitors- 2 (B), Inhibitor of microtubule assembly- 3 (K1)
Stellar	Valent	flumiclorac (7.6%) + lactofen (26.6%)	PPO inhibitors- 14 (E)
Sterling Plus	Agriliance	atrazine (2.1 lbs or 22.23%) + dicamba (1.1 lbs or 11.45%)	PSII site A- 5 (C1), auxin mimic- 1 (O)

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Stout	DuPont	nicosulfuron (67.5%) + thifensulfuron (5%)	ALS-inhibitors- 2 (B)
Strategy	UAP-Loveland	clomazone (0.5 lb or 5.6%) + ethalfluralin (1.6 lbs or 18.2%)	DOXP synthase- 13 (F4), Inhibitor of microtubule assembly- 3 (K1)
Strike 3	Agriliance	2,4-D (2.44 lbs or 25.38%)+ dicamba (0.22 lb or 2.3%) + mecoprop-p (0.63 lb or 6.75%)	auxin mimic- 1 (O)
Strike 3 Ultra	Agriliance	2,4-D (2.9 lbs or 30%) + clopyralid (0.15 lb or 1.5%) + dichlorprop-p (0.75 or 7.8%)	auxin mimic- 1 (O)
Strike 3 Ultra 2	Agriliance	2,4-D (3.2 lbs or 32.64%) + fluroxypyr (0.4 lb or 4.08%) + dichlorprop-p (0.8 lb or 8.16%)	auxin mimic- 1 (O)
Stronghold	PBI Gordon	imazapyr (0.01 lb or 0.14%) + imazethapyr (0.35 lb or 3.86%) + mefluidide (1.46 lbs or 16.02%)	ALS-inhibitors- 2 (B) + plant growth regulator
SuperBrush Killer	PBI Gordon	2,4-D (1.89 lbs or 21.54%) + dichlorprop-p (0.94 lb or 10.77%) + dicamba (0.47 lb or 5.38%)	auxin mimic- 1 (O)
Super Trimec	PBI Gordon	2,4-D (1.89 lbs or 21.54%) + dicamba (0.47 lb or 5.38%) + 2,4-DP-p (0.94 lbs or 10.77%)	auxin mimic- 1 (O)
Suprend	Syngenta	prometryn (79.3%) + trifloxysulfuron (0.7%)	PSII site A- 5 (C1), ALS-inhibitor- 2 (B)
Surefire	Platte/ UAP-Loveland	paraquat (2 lbs) + diuron (1 lb)	Photosystem I electron diverter- 22 (D), PSII site A2- 7 (C2)
SureStart	Dow	acetochlor (3.75 lbs or 41.67%) + flumetsulam (0.12 lb or 1.3%) + clopyralid (0.29 lb or 3.24%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), ALS-inhibitor- 2 (B), auxin mimic- 1 (O)
Surge	PBI Gordon	2,4-D (1.4 lbs or 15.66%), mecoprop-p (0.5 lb or 5.62%), dicamba (0.22 lb or 2.52%), sulfentrazone (0.06 lb or 0.67%)	auxin mimic- 1 (O), PPO inhibitor- 14 (E)
Surmount	Dow	picloram (0.67 lb acid or 1.19 lb or 13.24% as its triisopropanolamine salt) + fluroxypyr (0.67 lb acid or 0.96 lb or 10.64% as its 1-methylheptyl ester)	auxin mimic- 1 (O)
Synchrony STS DF	DuPont	chlorimuron (18.7%) + thifensulfuron (6.3%)	ALS-inhibitors- 2 (B)
Synchrony XP	DuPont	chlorimuron (21.5%) + thifensulfuron (6.9%)	ALS-inhibitors- 2 (B)
STS Broadleaf	DuPont	chlorimuron (10%) + thifensulfuron (30%)	ALS-inhibitors- 2 (B)
Storm	BASF/United Phosphorous	bentazon (2.67 lb or 29.2% as its sodium salt) + acifluorfen (1.33 lbs or 13.4% as its sodium salt)	PSII site B- 6 (C3), PPO inhibitor- 14 (E)
Tailspin	UAP-Loveland	fluroxypyr (0.33 lb or 3.87%) + triclopyr (1 lb or 11.62%)	auxin mimic- 1 (O)
Team 2G	Dow	benefin (1.33%) + trifluralin (0.67%)	Inhibitors of microtubule assembly- 3 (K1)
Team Pro	Dow	benefin (0.43%) + trifluralin (0.43%) + fertilizer	Inhibitors of microtubule assembly- 3 (K1)
Telone C-15	TRICAL	chloropicrin (14.8%) + 1,3-dichloropropene (82.9%)	unknown (Z)- fumigants
Telone C-17	Dow	chloropicrin (1.75 lbs or 16.5%) + 1,3-dichloropropene (8.6 lbs or 81.2%)	unknown (Z)- fumigants
Telone C-35	Dow	chloropicrin (3.89 lbs or 34.7%) + 1,3-dichloropropene (7.1	unknown (Z)- fumigants

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		lbs or 63.4%)	
Thunder Master	Albaugh/Agri Star	glyphosate (2 lbs or 22% as its isopropylamine salt) + imazethapyr (0.17 lb or 1.8%)	EPSP synthase- 9 (G), ALS-inhibitors- 2 (B)
Tiller	Bayer	fenoxaprop (0.44 lb) + MCPA (1.75 lb) + 2,4-D (0.58 lb)	ACCase inhibitor- 1 (A), auxin mimic- 1 (O)
Top gun	UAP-Loveland	2,4-D (71.2%) + metribuzin (18.8%)	auxin mimic- 1 (O), PSII site A- 5 (C1)
Topsite 2G	SSI Maxim/BASF	diuron (2%) + imazapyr (0.5%)	PSII site A2- 7 (C2), ALS-inhibitor- 2 (B)
Tordon 101 Mixture	Dow	picloram (0.54 lb or 5.7%) + 2,4-D (2 lbs or 21.2%)	auxin mimic- 1 (O)
Tordon RTU	Dow	picloram (3%) + 2,4-D (11.2%)	auxin mimic- 1 (O)
Total	Agriliance	bromacil (2%) + diuron (2%) + sodium chlorate (40%) + sodium metaborate (40%)	PSII site A- 5 (C1), PSII site A2- 7 (C2), unknown (Z)- fumigants
Three-way Ester II Selective	Lesco	MCPA (3 lbs) + triclopyr (0.3 lb) + dicamba (0.3 lb)	auxin mimic- 1 (O)
Throttle XP	DuPont	chlorsulfuron (9%) + sulfometuron (18%) + sulfentrazone (48%)	ALS-inhibitors- 2 (B), PPO inhibitor- 14 (E)
Triamine	Nufarm/ Riverdale	mecoprop-p (0.62 lb or 6.8%) + 2,4-D (1.24 lbs or 13.6%) + dichlorprop-p (0.62 lb or 6.8%)	auxin mimic- 1 (O)
Triamine Jet Spray Spot Weed Killer	Nufarm/ Riverdale	mecoprop-p (0.011 lb or 0.135%) + 2,4-D (0.023 lbs or 0.27%) + dichlorprop-p (0.011 lb or 0.135%)	auxin mimic- 1 (O)
Triamine II	Nufarm/ Riverdale	mecoprop-p (0.63 lb or 7%) + MCPA (1.27 lbs or 14%) + dichlorprop-p (0.63 lb or 7%)	auxin mimic- 1 (O)
Triangle	Tenkoz	metolachlor (3.2 lbs or 34.5%) + atrazine (2.7 lbs or 29.1%- atrazine + related triazines)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Tri-Ester	Nufarm/ Riverdale	MCPP (24.4% as its isooctyl ester) + 2,4-D (24% as its 2-ethylhexyl ester) + 2,4-DP (33.5% as its isooctyl ester)	auxin mimic- 1 (O)
Tri-Ester TM II	Nufarm/ Riverdale	MCPP (25% as its 2-ethylhexyl ester) + MCPA (25.6% as its 2-ethylhexyl ester) + 2,4-DP (24.2% as its 2-ethylhexyll ester)	auxin mimic- 1 (O)
Trimec 899	PBI Gordon	dicamba (0.21 lb) + mecoprop-p (0.63 lb) + 2,4-D (2.38 lbs)	auxin mimic- 1 (O)
Trimec 959	PBI Gordon	dicamba (0.29 lb) + mecoprop-p (0.63 lb) + 2,4-D (2.97 lbs)	auxin mimic- 1 (O)
Trimec 992 or Trimec Turf Herbicide (891)	PBI Gordon	dicamba (0.21 lb or 2.3%) + mecoprop-p (0.63 lbs or 6.75%) + 2,4-D (2.38 lbs or 25.38%)	auxin mimic- 1 (O)
Trimec Bentgrass Formula	PBI Gordon	dicamba (0.18 lb or 2.1%) + mecoprop-p (0.71 lbs or 8.2%) + 2,4-D (0.44 lbs or 5.08%)	auxin mimic- 1 (O)
Trimec Classic	PBI Gordon	dicamba (0.21 lb or 2.29%) + mecoprop-p (0.53 lb or 5.73%) + 2,4-D (1.98 lbs or 21.54%)	auxin mimic- 1 (O)
Trimec DMB 32 S.I.	PBI Gordon	dicamba (4.3%) + mecoprop-p (10.2%) + 2,4-D (45.6%)	auxin mimic- 1 (O)
Trimec Encore	PBI Gordon	MCPA (2.97 lb or 31.59%) + mecoprop-p (0.63 lb or 6.74%)	auxin mimic- 1 (O)

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Broadleaf		+ dicamba (0.29 lbs or 3.16%)	
Trimec LAF-637	PBI Gordon	dicamba (0.093 lb) + mecoprop-p (0.22 lb) + 2,4-D (0.75 lb)	auxin mimic- 1 (O)
Trimec Lawn Weed Killer	PBI Gordon	dicamba (0.13 lb or 1.39%) + mecoprop-p (0.55 lbs or 5.75%) + 2,4-D (3.28 lbs or 34.12%)	auxin mimic- 1 (O)
Trimec Plus	PBI Gordon	dicamba (0.12 lb or 1.21%) + mecoprop-p (0.24 lb or 2.42%) + 2,4-D (0.48 lb or 4.84%) + MSMA (1.8 lbs or 18%)	auxin mimic- 1 (O), unknown 17 (Z)- organoarsenicals
Trimec Southern Broadleaf Weed Killer	PBI Gordon	dicamba (0.3 lb or 3.2%) + mecoprop-p (1.32 lbs or 14.35%) + 2,4-D (1.44 lbs or 15.57%)	auxin mimic- 1 (O)
Trimec (Super)	PBI Gordon	2,4-D (1.89 lbs or 21.54%)+ dicamba (0.47 lb or 5.38%) + 2,4-DP-p (0.94 lb or 10.77%)	auxin mimic- 1 (O)
Trimec Turf	PBI Gordon	dicamba (0.22 lb or 2.33%) + mecoprop (1.3 lbs or 13.5%) + 2,4-D (2.44 lbs or 25.38%)	auxin mimic- 1 (O)
Triple Strike Grass Weed Root Killer$_2$	Spectrum Group/ Spectracide	diquat (2.3% as its dibromide salt) + fluazifop-p-butyl (0.75%) + dicamba (0.51% as its dimethylamine salt)	Photosystem I electron diverter- 22 (D), ACCase inhibitor- 1 (A), auxin mimic- 1 (O)
Triple Threat Selective Herbicide	Total Solutions	2,4-D (0.33 lb or 3.8%) + mecoprop (0.33 lb or 3.8%) + dichlorprop (0.33 lb or 3.8%)	auxin mimic- 1 (O)
Triplet Hi-D	Nufarm/ Riverdale	2,4-D (3.3 lb or 34.12%) + mecoprop-p (0.56 lbs or 5.75%) + dicamba (0.13 lb or 1.39%)	auxin mimic- 1 (O)
Triplet Low Odor	Nufarm/ Riverdale	2,4-D (2.38 lb or 25.38%) + mecoprop-p (0.63 lbs or 6.75%) + dicamba (0.22 lb or 2.30%)	auxin mimic- 1 (O)
Triplet Selective	Nufarm/ Riverdale	2,4-D (2.38 lb or 25.38%) + mecoprop-p (0.63 lbs or 6.75%) + dicamba (0.22 lb or 2.3%)	auxin mimic- 1 (O)
Triplet Sensitive	Nufarm/ Riverdale	2,4-D (0.82 lb or 9.02%) + mecoprop-p (1.43 lbs or 15.63%) + dicamba (0.35 lb or 3.84%)	auxin mimic- 1 (O)
Triplet SF	Nufarm/ Riverdale	2,4-D (2.38 lb or 25.38%) + mecoprop-p (0.63 lbs or 6.75%) + dicamba (0.22 lb or 2.30%)	auxin mimic- 1 (O)
Tri-Scept	BASF	Imazaquin (4.72% as its monoammonium salt) + trifluralin (28.6%)	ALS-inhibitor- 2 (B), Inhibitor of microtubule assembly- 3 (K1)
Trizmet II	Drexel	metolachlor (2.4 lbs or 26.1%) + atrazine (3.1 lbs or 33.7%- atrazine + related triazines)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
TruPower	Nufarm/ Riverdale	clopyralid (0.37 or 3.93%) + dicamba (0.37 lb or 3.93%) + MCPA (3.75 lbs or 39.3%)	auxin mimic- 1 (O)
TruPower II	Nufarm/ Riverdale	2,4-D (2.45 lbs or 26%) + dicamba (0.31 lb or 3.24%) + mecoprop-p (0.61 lb or 6.5%)	auxin mimic- 1 (O)
Turbo	Bayer	metolachlor (6.55 lbs or 70%) + metribuzin (1.45 lbs or 15%)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Turf Weed & Brush	Nufarm/	2,4-D (1.71 lbs or 21.3%) + dichlorprop-p (0.87lb or 10.9%)	auxin mimic- 1 (O)

Trade Name	Company	Common Name of Individual Herbicides [percent ai (liquid or dry) or lbs ai/gal (liquid) or lb ai/ lb product (dry) represented in parentheses]	Site/Mode of action of herbicides represented in this product†^
	Riverdale		
Turflon D	Dow	2,4-D (2 lbs) + triclopyr (1 lb)	auxin mimic- 1 (O)
Turflon II Amine	Dow	2,4-D (2.78 lbs or 28.4%) + triclopyr (1.07 lbs or 10.9%)	auxin mimic- 1 (O)
Typhoon	Syngenta	fluazifop-p-butyl (5.3%) + fomesafen (11% as its sodium salt)	ACCase inhibitor- 1 (A), PPO inhibitors- 14 (E)
Ureabor	Pro-Chem	sodium metaborate (66.5%) + sodium chlorate (30%) + bromacil (1.5%)	unknown (Z)- fumigants, PSII site A- 5 (C1)
Vegemac	PBI Gordon	2,4-D (1%) + premeton (3.6%)	auxin mimic- 1 (O), PSII site A- 5 (C1)
Valor XLT	Valent	flumioxazin (30%) + chlorimuron (10.3%)	PPO inhibitors- 14 (E), ALS-inhibitor- 2 (B)
Velpar Alfamax	DuPont	hexazinone (35.3%) + diuron (42.4%)	PSII site A- 5 (C1), PSII site A2- 7 (C2)
Velpar Alfamax Gold	DuPont	hexazinone (23.1%) + diuron (55.4%)	PSII site A- 5 (C1), PSII site A2- 7 (C2)
Velpar K-4 Max	DuPont	hexazinone (17.3%) + diuron (61.5%)	PSII site A- 5 (C1), PSII site A2- 7 (C2)
Vendetta	Wilbur-Ellis	bromoxynil (2 lbs or 21.8%) + MCPA (2 lbs or 21.8%)	PSII site B- 6 (C3), auxin mimic- 1 (O)
Vengeance	Wilbur-Ellis	2,4-D (2.5 lbs) + dicamba (1.25 lbs)	auxin mimic- 1 (O)
Vengeance Plus	Wilbur-Ellis	MCPA (3.72 lbs or 38.27%) + triclopyr (0.75 lb or 7.65%) + dichlorprop-p (0.75 lb or 7.65%)	auxin mimic- 1 (O)
Vessel	Prokoz Inc.	dicamba (0.21 lb) + mecoprop-p (0.63 lb) + 2,4-D (2.38 lbs)	auxin mimic- 1 (O)
Vigoro Ultra Turf Lawn Weed Control	Spectrum Group/ Vigoro	2,4-D (1.37%) + mecoprop-p (0.31%) + dicamba (0.13%)	auxin mimic- 1 (O)
Vigoro Ultra Turf Weed and Feed	Spectrum Group/ Vigoro	2,4-D (0.26 lb or 2.7%) + mecoprop-p (0.13 lb or 1.35%) + dichlorprop-p (0.13 lb or 1.35%)	auxin mimic- 1 (O)
Volley ATZ	Tenkoz	acetochlor (3 lbs or 32.6%) + atrazine (2.25 lbs or 24.4%- atrazine + related triazines)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Volley ATZ Lite	Tenkoz	acetochlor (4 lbs or 43.4%) + atrazine (1.5 lbs or 16.3%- atrazine + related triazines)	Inhibitor of very long chain fatty acid biosynthesis- 15 (K3), PSII site A- 5 (C1)
Weed and Grass Killer	Spectrum Group/ Spectracide	diquat (0.18% as its dibromide salt) + fluazifop-p-butyl (0.06%) + dicamba (0.04% as its dimethylamine salt)	Photosystem I electron diverter- 22 (D), ACCase inhibitor- 1 (A), auxin mimic- 1 (O)
Weed-B-Gon MAX plus Crabgrass Control Ready-to-use	Ortho	2,4-D (0.12%) + quinclorac (10%) + MCPP (0.22%) + dicamba (0.05%)	auxin mimic- 1 (O)
Weed-B-Gon MAX Weed Killer for Lawns Ready-to-use	Ortho	2,4-D (0.12%) + MCPP (0.22%) + dicamba (0.05%)	auxin mimic- 1 (O)
Weed-B-Gon MAX Weed Killer for Lawns	Ortho	triclopyr (1.56%) + MCPA (13.72%) + dicamba (1.35%)	auxin mimic- 1 (O)

Trade Name	Company	Common Name of Individual Herbicides [percent ai (liquid or dry) or lbs ai/gal (liquid) or lb ai/ lb product (dry) represented in parentheses]	Site/Mode of action of herbicides represented in this product†^
Ready-spray or Concentrate			
Weed-B-Gon for Southern Lawns Ready-spray or Concentrate	Ortho	2,4-D (3.05%) + MCPP (5.3%) + dicamba (1.3%)	auxin mimic- 1 (O)
Weed Blast	UAP- Loveland	bromacil (4%) + diuron (4%)	PSII site A- 5 (C1), PSII site A2- 7 (C2)
Weed Blast 4G	SSI Maxin	bromacil (2%) + diuron (2%)	PSII site A- 5 (C1), PSII site A2- 7 (C2)
Weed & Feed 5M	Spectrum Group/ Vigoro	2,4-D (0.64%) + mecoprop-p (0.16%) + dicamba (0.03%)	auxin mimic- 1 (O)
Weed & Feed 15M	Spectrum Group/ Vigoro	2,4-D (1.108% as its ethylhexyl ester) + mecoprop-p (0.167%) + dicamba (0.71%)	auxin mimic- 1 (O)
Weed Free 75	Harrell's	trifluralin (3%) + oxyfluorfen (2%)	Inhibitors of microtubule assembly- 3 (K1), PPO inhibitors- 14 (E)
Weedking	Control Solutions	2,4-D (2.87 lbs) + dicamba (1 lb)	auxin mimic- 1 (O)
Weedmaster	BASF	dicamba (1 lb or 10.3%) + 2,4-D (2.87 lbs or 29.6%)	auxin mimic- 1 (O)
Weed Out	Pro-Chem	2,4-D (1.09%) + bromacil (0.98%)	auxin mimic- 1 (O), PSII site A- 5 (C1)
Weed Stop 2X Weed Killer for Lawns Concentrate	Spectrum Group/ Spectracide	2,4-D (0.54 lb or 6.31%) + mecoprop-p (0.19 lb or 2.25%) + dicamba (0.05 lb or 0.59%) + sulfentrazone (0.02 lb or 0.18%)	auxin mimic- 1 (O), PPO inhibitor- 14 (E)
Weed Stop 2X Weed Killer for Lawns Ready-to-use	Spectrum Group/ Spectracide	2,4-D (0.285%) + mecoprop-p (0.102%) + dicamba (0.027%) + sulfentrazone (0.008%)	auxin mimic- 1 (O), PPO inhibitor- 14 (E)
Westar	DuPont	hexazinone (68.6%) + sulfometuron (6.5%)	PSII site A- 5 (C1), ALS-inhibitor- 2 (B)
WideMatch	Dow	clopyralid (0.75 lb or 8.6%) + fluroxypyr (0.75 lb or 8.6%)	auxin mimic- 1 (O)
WideMatch M	Dow	**Part S:** fluroxypyr (1.5 lbs or 18.2%) + **Part CM:** clopyralid (0.42 lb or 5%) + MCPA (2.35 lbs or 27.8%)	auxin mimic- 1 (O)
Wildcard Xtra	Helena	bromoxynil (2 lbs or 21.8%) + MCPA (2 lbs or 21.8%)	PSII site B- 6 (C3), auxin mimic- 1 (O)
Wil-Power	Wilbur-Ellis	MCPA (3.72 lbs or 38.27%)+ triclopyr (0.75 lb or 7.65%) + dichlorprop-p (0.75 lb or 7.65%)	auxin mimic- 1 (O)
XL 2G	Helena	benefin (1%) + oryzalin (1%)	Inhibitors of microtubule assembly- 3 (K1)
Yukon	Gowan	dicamba (55% as its sodium salt) + halosulfuron (12.5%)	auxin mimic- 1 (O), ALS-inhibitor- 2 (B),

***Disclaimer:** Great efforts were made to incorporate the most recent information regarding the herbicide products listed above; however, some of the products above may no longer be registered or other products with similar names may be present in the marketplace. This document is not intended to replace any product labels, therefore, please consult specific product labels for the most recent and accurate information regarding the use of any

product(s) mentioned above. When possible, all percentage and lb ai/gallon ratios are based on active ingredient or acid equivalent and not on specific salts or esters of these active ingredients. If the percentage ai or lb ai/gallon ratios are based on a specific type of salt or ester of an active ingredient, it should be designated as such in parentheses (especially where a multitude of various salt and/or ester combinations are possible for a specific herbicide active ingredient).

Herbicide Sites of Action†

^ For each site of action represented in this publication there is an associated number and letter group code (i.e., auxin mimic has the number code "1" and the letter code "(O)"). The number code represents the herbicide site of action classification system used by the Weed Science Society of America (WSSA), while the letter code corresponds to the classification system used by the Herbicide Resistance Action Committee (HRAC). These systems were created to aid decision makers in rotating herbicides with different sites of action to prevent or manage resistant weed populations. Currently, the Canadian Pest Management Regulatory agency requires that all herbicide manufacturers place the corresponding site of action number code (WSSA system) for each individual herbicide active ingredient on all herbicide labels in Canada. In contrast, the United States Environmental Protection Agency (EPA) announced that such site of action disclosures on labels in the United States would be strictly voluntary. Currently, some companies like Dow Agrosciences and Syngenta Crop Protection voluntarily include this information on their new herbicide labels (Mallory-Smith and Retzinger 2003).

1 (A)- Inhibitor of acetyl CoA carboxylase (ACCase) **–** inhibits long chain fatty acid biosynthesis in grasses with concurrent safety to broadleaf weeds and crops. Most of the herbicides that inhibit this site of action have little to no soil residual activity, so the majority of the activity comes from foliar applications. Activity generally appears within the first week of application with chlorosis and a loss of apical dominance in the meristem with concurrent reddening in certain leaf tissue. Complete control of susceptible species may require two to three weeks following applications. Many of these herbicides are systemic in nature and can have activity on both annual and perennial grass weeds. Antagonism (or reduced herbicidal activity) has been observed in certain weed species when applied in mixtures with auxin mimic- 1 (O) herbicides or ALS inhibitors- 2 (B). Currently, there are 35 different species in more than 120 locations that have demonstrated resistance to this herbicide site of action; some of those species of importance to Tennessee include Italian ryegrass and johnsongrass.

2 (B)- Inhibitor of acetolactate synthase (ALS) **–** inhibits the formation of the branched chain amino acids valine, leucine and isoleucine. Five major classes of chemistry inhibit this enzyme and residual activity, crop selectivity and the spectrum of weeds controlled can vary greatly depending on the herbicide selected. Activity generally appears within the first week of application as chlorosis with the possibility of some purple leaf veins appearing on the leaves of some plants; roots may have a bottlebrush appearance in some species. Complete control of susceptible species may require two to three weeks following applications. Many of these herbicides are systemic in nature and can have activity on both annual and perennial weed species. Antagonism (or reduced herbicidal activity) has been observed in certain weed species when applied in mixtures with ACCase inhibitors- 1 (A) or HPPD inhibitors- 27 (F2). Synergism (or improved herbicidal activity) has been observed in certain weed species when applied in mixtures with inhibitors of EPSP synthase- 9 (G). Currently, there are 95 different species in more than 275 locations that have demonstrated resistance to this herbicide site of action; some of those species of importance to Tennessee include common cocklebur, common waterhemp and Palmer amaranth.

3 (K1)- Inhibitor of microtubule assembly – inhibits tubulin formation in cells, which blocks the completion of cell division (mitosis) and in turn prevents shoot elongation and the lateral root development in emerging weeds. In general, chemicals that inhibit microtubule assembly are volatile and susceptible to photolytic degradation, so the activity of many of these herbicides can be enhanced by immediate incorporation following preemergence applications. These herbicides typically control many annual grasses and certain small seeded broadleaf weeds in several grass or broadleaf crops. Weed seedlings that absorb inhibitors of microtubule assembly generally emerge abnormally with rapid cessation of vertical shoot growth. Seedlings appear stunted and roots appear club-shaped. Complete plant death occurs within one to two weeks after seedling emergence. Even though these herbicides are readily absorbed by plants, they are not systemic and therefore are only effective for preemergence control of annual weeds. Crop selectivity to inhibitors of microtubule assembly can generally be attributed to three different things: 1) the herbicide is placed in the soil where it can come in contact with emerging weed seedlings, but not emerging crop seedlings 2) crop seeds are generally larger with more energy reserves than many smaller seeded weed species and this difference allows them to better withstand the herbicidal activity of inhibitors of microtubule assembly 3) herbicide safeners are incorporated with these herbicides to improve crop safety by enhancing metabolism of the herbicide. Currently, there are 10 different species in more than 25 locations that have demonstrated resistance to this herbicide site of action; one species of particular importance to Tennessee is goosegrass.

4 (O)- Synthetic auxins (auxin mimic) – herbicides that mimic the internal plant hormone indole-3-acetic acid (IAA or auxin). These herbicides cause uncontrolled plant growth that leads to twisting, leaf cupping, stem cracking and ultimately plant death in susceptible annual and perennial broadleaf weeds and crops. Grass weeds and crops are generally safe to standard use rates of auxin herbicides due to an extra layer of specialized cells (schlerenchyma) that protect the vascular transport system (xylem and phloem) from closure due to stem twisting (epinasty). With few exceptions (i.e., picloram), auxin herbicides typically have only moderate to low residual activity, with the majority of their activity coming from foliar absorption. Symptoms typically appear within one day after application; however, susceptible plants may take up to two to four weeks to completely die. Many of these herbicides are systemic in nature and can have activity on both annual and perennial broadleaf weed species. Antagonism (or reduced herbicidal activity) has been observed in certain weed species when applied in mixtures with ACCase inhibitors- 1 (A). Synergism (or improved herbicidal activity) has been observed in certain weeds species when applied in mixtures with inhibitors of indoleacetic acid transport- 19 (P). Currently, there are 25 different species in more than 35 locations that have demonstrated resistance to this herbicide site of action; so far, no resistant biotypes to this mode of action have been confirmed in Tennessee.

5 (C1)- Inhibitor of photosynthesis at photosystem II site A (PSII site A) – inhibitors of photosystem II bind to one of two sites (A or B). Through this binding they prevent the orderly flow of electrons (free electrons are generated by plants through absorption of sunlight) out of photosystem II, causing cell membrane degradation and necrosis in plant tissue. Symptoms generally appear as yellow leaf tissue in between leaf veins (interveinal chlorosis) on older leaf tissue within one to three days after application and these symptoms progress to the new leaves (meristem) of plants as the herbicide moves upward from the roots with water and other nutrients (apoplastically) over time. This chlorotic tissue typically becomes necrotic quite rapidly, but symptoms and timing can differ among various inhibitors of photosystem II. PSII inhibitors that bind to site A (C1) generally provide selective residual control of several broadleaf weeds and certain grasses in a variety of crop and non-crop environments, but a majority of the herbicides that bind to this site are used in monocot crops (i.e., turf, rice, corn, cereals, sugarcane, etc.). Because of its apoplastic movement, the success of foliar activity is generally dependent on aggressive adjuvants and applications made to smaller weeds. Synergism (or improved herbicidal activity) has been observed in certain weeds species when applied in mixtures with inhibitors of PPO- 14 (E), HPPD- 27 (F2), Photosystem I electron diverters- 22 (D) and DOXP synthase- 13 (F4). Currently, there are 66 different species in nearly 400 locations that have demonstrated resistance to this specific herbicide site of action; one species of particular importance to Tennessee is common lambsquarters.

7 (C2)- Inhibitor of photosynthesis at photosystem II site A different binding behavior than C1 (PSII site A2) **–** herbicides that bind at site A2- 7 (C2) in photosystem II are usually applied preemergence in crop and non-crop areas, but most also have some significant postemergence foliar activity. Typically, herbicides that bind at this site of action generally have less movement in soil in comparison to PSII inhibitors that bind at site A-5 (C1). This usually impacts the spectrum of weeds controlled and the type of crop selectivity when comparing these two different herbicide sites of action. Synergism (or improved herbicidal activity) has been observed in certain weed species when applied in mixtures with inhibitors of PPO- 14 (E), HPPD- 27 (F2), Photosystem I electron diverters- 22 (D) and DOXP synthase- 13 (F4). Currently, there are 21 different species in more than 50 locations that have demonstrated resistance to this specific herbicide site of action; so far, no resistant biotypes to this mode of action have been discovered in Tennessee.

6 (C3)- Inhibitor of photosynthesis at photosystem II site B (PSII site B) **–** herbicides that bind to site B of the D1 protein in photosynthesis behave slightly different than those that bind to site A. Typically these compounds have little to no soil residual activity, and in general the majority of their activity is from foliar applications. In addition, susceptible weeds typically display rapid necrosis within one to two days after application, with plant death ensuing rapidly. Also, PSII site B inhibitors are generally only active against broadleaf weeds and have little to no activity on grasses. This is the reason why all are registered for use in corn and/or certain specialty crops. Synergism (or improved herbicidal activity) has been observed in certain weed species when applied in mixtures with inhibitors of PPO- 14 (E), HPPD- 27 (F2) and DOXP synthase- 13 (F4). Currently, there is only one weed (common groundsel) in only one location (Oregon) that has demonstrated resistance to this specific herbicide site of action; so far, no resistant biotypes to this mode of action have been discovered in Tennessee.

8 (N)- Inhibitors of lipid synthesis **–** thiocarbamates are the only class of chemistry that function as lipid synthesis inhibitors, but the specific site(s) of action that these herbicides target is/are not fully understood. These herbicides not only decrease the production of lipids (leading to destabilization of cell membranes and cessation of cell division or enlargement) but have also been found to inhibit the production of the plant hormone gibberellic acid (leading to plant growth reductions) and can affect chromosome and general nuclei development in the shoot cells of susceptible seedlings. In addition, many of the herbicides that target this mode of action are extremely volatile and are therefore incorporated immediately after application. Lipid synthesis inhibitors provide broad-spectrum control of many grasses and broadleaf weeds and often get their selectivity to target crops through the use of safeners or through specific placement of the herbicide in the soil profile to avoid contact with emerging crop shoots (similar to inhibitors of microtubule assembly). Typical symptoms from lipid synthesis inhibitors include stunting, dark green leaf tissue, puckered leaves (broadleaf weeds) and a special symptom called "buggy whipping" whereby the leaves of certain grasses have trouble releasing from the protective sheath of the shoot tip (coleoptile). Currently, there are eight different species in more than 15 locations that have demonstrated resistance to this specific herbicide site of action; so far, no resistant biotypes to this mode of action have been discovered in Tennessee.

9 (G)- Inhibitor of 5-enolpyruvyl-shikimate-3-phosphate synthase (EPSP synthase) **–** inhibits the formation of the aromatic amino acids phenylalanine, tryptophan and tyrosine. Currently, glyphosate is the only commercial product that targets this specific site of action. Following postemergence treatment, susceptible plants become chlorotic and stunted within five to seven days after application. Complete plant death may take up to two to four weeks following application. Glyphosate is systemic and can therefore provide excellent control of both annual and perennial weeds. However, its lack of soil residual activity creates a need for tank mix partners or multiple applications for full-season weed control. Antagonism (or reduced herbicidal activity) has been observed in certain weed species when applied in mixtures with Photosystem I electron diverters- 22 (D) or PPO inhibitors- 14 (E). Synergism (or improved herbicidal activity) has been observed in certain weeds species when applied in

mixtures with ALS inhibitors- 2 (B). Currently, there are 13 different species in more than 50 locations that have demonstrated resistance to this herbicide site of action; two species of particular importance to Tennessee are horseweed and Palmer amaranth.

10 (H)- Inhibitor of glutamine synthetase **–** inhibits the conversion of the amino acid glutamate plus ammonia to the amino acid glutamine. This leads to an impairment of nitrogen metabolism and an accumulation of toxic levels of ammonia in susceptible plants, which in turn inhibits photosynthesis causing lipid peroxidation of cell membranes in the presence of sunlight. Currently, glufosinate is the primary commercial product that targets this specific site of action. This herbicide only has postemergence activity (no soil residual activity) and since it does not translocate effectively, it must be evenly applied to sufficiently control most target plants. In addition, glufosinate is very sensitive to extremes in temperature and humidity, which can impact its performance. While glufosinate is considered a non-selective herbicide, it does tend to provide more consistent control of most annual broadleaf weeds in comparison to certain grass species. Following postemergence application of glufosinate, susceptible plants tend to become chlorotic/necrotic within one to three days after application; total plant death generally occurs within five to 10 days after application. Synergism (or improved herbicidal activity) has been observed in certain weed species when applied in mixtures with inhibitors of Photosystem I electron diverters- 22 (D). Currently, there are no weeds that have demonstrated resistance to this herbicide site of action.

13 (F4)- Inhibitor of 1-deoxy-D-xylulose-5-phosphate synthatase (DOXP synthase) **–** prevents carotenoid production by inhibition of the terpenoid pathway. Currently, clomazone is the only commercial product that targets this specific site of action. Following preemergence applications, susceptible weed seedlings emerge bleached or chlorotic in appearance. These plants then become necrotic and die within five to 14 days after emergence. Clomazone controls many broadleaf and grass weeds in several horticultural crops (i.e. pumpkins, peppers, cucumbers, sweet potato, etc.), tobacco and soybean, but must be applied carefully as it is extremely volatile and can cause damage to sensitive non-target plants if used improperly. Synergism (or improved herbicidal activity) has been observed in certain weed species when applied in mixtures with PSII site A inhibitors- 5 (C1). Currently, there are no weeds that have demonstrated resistance to this herbicide site of action.

14 (E)- Inhibitor of protoporphyrinogen IX oxidase (PPO or Protox) **–** cause cell membrane degradation by causing protoporphyrin IX to accumulate in the cytoplasm where it can react with oxygen and sunlight to create toxic oxygen species that lead to cell membrane degradation. In addition, PPO inhibitors also impair the production of chlorophyll in plants. Given these dual roles in membrane and chlorophyll degradation, it is not surprising that PPO inhibitors cause rapid burn in susceptible weeds and crops within one day after postemergence treatment. Certain PPO inhibitors also have some soil residual activity (i.e., sulfentrazone, flumioxazin, etc.), which causes susceptible weeds to germinate with yellow- to orange-colored foliage. Following exposure to sunlight, they turn necrotic quite rapidly. Many PPO inhibitors are applied for weed control in soybeans; however, more recent chemistry has established the use of PPO inhibitors in several grass and horticultural crops as well. PPO inhibitors are typically more active on broadleaf weeds in comparison to most grasses and are better on annual weeds as opposed to perennial weeds because they do not translocate well in plants. Antagonism (or reduced herbicidal activity) has been observed in certain weed species when applied in mixtures with EPSP synthase inhibitors- 9 (G). Synergism (or improved herbicidal activity) has been observed in certain weed species when applied in mixtures with PSII site B inhibitors- 6 (C3) or HPPD inhibitors- 27 (F2). Currently, there are three different species in five locations that have demonstrated resistance to this herbicide site of action; so far, no resistant biotypes to this mode of action have been discovered in Tennessee.

15 (K3)- Inhibitors of synthesis of very long chain fatty acid **–** inhibit cell growth and cell division by impairing membrane formation, which leads to inhibition of shoot and root growth in seedling weeds. In general, preemergence applications either prevent seedlings from emerging through the soil surface or seedlings emerge stunted with either very dark green or sometimes chlorotic foliage. Inhibitors of very long chain fatty acids generally provide preemergence control of many annual grasses, sedges and some small-seeded broadleaf weeds (i.e., pigweed). Herbicides in this group are

registered in a number of grass and broadleaf crops; however, much of the safety afforded with many of these products in grass crops is due to the incorporation of a herbicide safener into their formulation. Currently, there are three different species in six locations that have demonstrated resistance to this herbicide site of action; so far, no resistant biotypes to this mode of action have been discovered in Tennessee.

19 (P)- Inhibitor of indoleacetic acid transport **–** inhibit a transport protein on the plasmalemma of cells that prevents internal plant auxins from moving out of the cells. This leads to a build-up of internal plant auxin in cells that creates symptoms similar to those caused by auxin mimic- 1 (O) herbicides. There are only two commercial compounds that inhibit this site of action 1) naptalam (Alanap) **–** a preemergence specialty crop herbicide (i.e., pumpkins, etc.) 2) diflufenzopyr **–** an auxin synergist that is currently only sold in combinations with dicamba (Distinct, Overdrive, Status). As diflufenzopyr demonstrates, inhibitors of indoleacetic acid transport- 19 (P) can be used to synergize the activity of auxin mimic- 1 (O) herbicides because they prevent these herbicides from leaving plant cells, just as they prevent internal plant auxins from doing the same thing. In addition to improving the control of certain broadleaf weeds in combinations with auxin herbicides (O) (i.e., dicamba), combinations of diflufenzopyr plus dicamba also improve herbicidal activity on certain annual grasses. Currently, there are no weeds that have demonstrated resistance to this herbicide site of action.

21 (L)- Inhibitor of cellulose synthase **–** inhibits cellulose production which prevents the proper formation of the cell wall during mitosis. Most inhibitors of cellulose synthase- 21 (L) prevent weeds from emerging above the soil surface, but those that do are often stunted, club-like in appearance and often have cracked stems. Inhibitors of cellulose synthase are generally active on a broad range of annual grasses and broadleaf weeds. Selectivity of these herbicides to certain plants is due to applications made after the target plant (i.e., crop, turf, ornamental, tree, etc.) has emerged or established and prior to the germination of weed species. Currently, there is one weed in one location that has demonstrated resistance to this herbicide site of action; so far, no resistant biotypes to this mode of action have been discovered in Tennessee.

22 (D)- Photosystem I electron diverter **–** accept free radicals near the ferrodoxin site in Photosystem I, which leads to the production of the highly oxidative compounds hydrogen peroxide, superoxide and various hydroxyl radicals that quickly peroxidize cell membranes leading to rapid cell degradation. Currently, paraquat and diquat are two bipyridylium herbicides that target this site of action. Symptoms from postemergence applications of these two herbicides can appear within one hour after application. Plants initially appear wilted and water-stressed but eventually rapid necrosis appears and plants can be completely dead in just a day or two following application. This rapid herbicidal response, coupled with no soil residual activity, has made these compounds ideal for rapid burndown of vegetation prior to planting, for use in between the rows of specialty crops or for use as a late-season crop desiccant. Antagonism (or reduced herbicidal activity) has been observed in certain weed species when applied in mixtures with EPSP synthase inhibitors- 9 (G). Synergism (or improved herbicidal activity) has been observed in certain weed species when applied in mixtures with inhibitors of PSII site A- 5 (C1), PSII site A2- 7 (C2) and glutamine synthetase- 10 (H). Currently, there are 23 different species in almost 40 locations that have demonstrated resistance to this herbicide site of action; so far, no resistant biotypes to this mode of action have been discovered in Tennessee.

27 (F2)- Inhibitor of 4-hydroxyphenyl-pyruvate-dioxygenase (HPPD **–** inhibits carotenoid production by impeding the production of plastoquinone, a key co-factor in carotenoid biosynthesis. In addition, the inhibition of HPPD also prevents the production of the anti-oxidant α-tocopherol (vitamin E) in susceptible plants. Plants treated with HPPD inhibitors typically develop bleaching symptoms in the new leaves (meristematic tissue) during the first week after application. These bleaching symptoms progress toward necrosis and susceptible plants generally die within two to three weeks after treatment. Most HPPD inhibitors (F2) provide postemergence control of key broadleaf weeds and certain grasses in corn; however, other herbicides in this class also provide weed control in wheat, rice and certain horticultural crops. In addition, some HPPD inhibitors (F2) have some soil residual

activity and can provide preemergence weed control (i.e., mesotrione, isoxaflutole, etc.). Antagonism (or reduced herbicidal activity) has been observed in certain weed species when applied in mixtures with ALS inhibitors (A). Synergism (or improved herbicidal activity) has been observed in certain weed species when applied in mixtures with inhibitors of PSII site A- 5 (C1), PSII site B- 6 (C3) and PPO- 14 (E). Currently, there are no weeds that have demonstrated resistance to this herbicide site of action.

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08-0158 PB1775-2.5M-3/08 E12-5115-00-011-08

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