

Managing Herbicide Resistant Weeds

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Herbicide resistant weeds in turf, such as *Poa annua*, spurge, goosegrass, and crabgrass, are becoming more prevalent. Fortunately, this can be contained if prudent action is taken. The following table summarizes the main herbicides used in turf including their timing (Pre- vs Post-emergence), their mechanism of action within plant (how they control them), and the various active ingredients. Rotating between and tank-mixing herbicides with different mechanisms of action are keys to delaying or preventing herbicide resistant weeds from dominating a population.

Timing	Mechanism of Action	Active Ingredient (Trade Name Example)
PRE	Cellulose biosynthesis inhibition	Indaziflam (Specticle)
	Mitotic (microtubule) inhibition	Benefin (Balan)
		Dithiopyr (Dimension)
		Oryzalin (Surflan)
		Pendimethalin (Pendulum)
		Prodiamine (Barricade)
		Trifluralin (Treflan)
	Lipid biosynthesis inhibition	Bensulide (Bensumec)
	Long-chain fatty acid inhibition	Dimethenamid (Tower)
Metolachlor (Pennant)		
PRE/POST	Mitotic (microtubule) inhibition	Pronamide (Kerb)
	Photosystem II inhibition – Site A	Atrazine (Aatrex)
		Metribuzin (Sencor)
		Simazine (Princep)
	Lipid biosynthesis inhibition	Ethofumesate (Prograss)
	Protoporphyrinogen oxidase (PPO) inhibition	Flumioxazin (SureGuard)
Oxadiazon (Ronstar)		
POST	Acetolactate synthase (ALS) inhibition	Bispyribac-sodium (Velocity)
		Chlorsulfuron (Corsair)
		Flazasulfuron (Katana)
		Foramsulfuron (Revolver)
		Imazaquin (Image)
		Metsulfuron (Manor)
		Rimsulfuron (TranXit)
		Sulfosulfuron (Certainty)
		Thiencarbazone-methyl
		Trifloxysulfuron (Monument)
	Acetyl CoA Carboxylase (ACCase) inhibition	Clethodim (Envoy)
		Fenoxprop (Acclaim Extra)
		Fluzafop (Fusilade)
		Sethoxydim (Vantage)
	Auxin agonist (growth regulators)	Clopyralid (Lontrel)
2,4-D (Weedone)		

Timing	Mechanism of Action	Active Ingredient (Trade Name Example)
		Dicamba (Banvel)
		Fluroxpyr (Spotlight)
		Mecoprop, MCPP (Mecomec)
		Quinclorac (Drive) (broadleaves)
	Carotenoid biosynthesis (HPPD, hydroxyphenyl-pyruvate-dioxygenase) inhibition	Mesotrione (Tenacity)
		Topramezone (Pylex)
	Cellulose biosynthesis inhibition	Quinclorac (Drive) (grasses)
	Enolpyruvyl Shikimate-3 Phosphate (EPSP) synthase inhibition	Glyphosate (Roundup)
	Glutamine synthetase inhibition	Glufosinate (Finale)
	Photosystem I inhibition	Diquat (Reward)
	Photosystem II inhibition – Site A	Amicarbazone (Xonerate)
	Photosystem II inhibition – Site B	Bentazon (Basagran)
		Bromoxynil (Buctril)
	Photosystem II inhibition – different binding site	Siduron (Tupersan)
	PPO or Protox (protoporphyrinogen oxidase) inhibition	Carfentrazone (Quicksilver)
		Sulfentrazone (Dismiss)
	Unknown	MSMA, DSMA