

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)*
Preemergence	Cellulose biosynthesis inhibition	Indaziflam (Specticle) Isoxaben (Gallery)
	Mitotic (microtubule) inhibition	Benefin (Balan) Dithiopyr (Dimension) Oryzalin (Surflan) Pendimethalin (Pendulum) Prodiamine (Barricade) Trifluralin (Treflan)
	Lipid biosynthesis inhibition	Bensulide (Bensumec)
	Long chain fatty acid biosynthesis inhibition	Metolachlor (Pennant)
	Protoporphyrinogen oxidase (PPO) inhibition	Oxadiazon (Ronstar)
Pre/Postemergence	Cellulose biosynthesis (grasses), synthetic auxin inhibition (broadleaves)	Quinclorac (Drive)
	Mitotic inhibition	Dimethenamid (Tower) Pronamide (Kerb)
	Photosystem II inhibition	Atrazine (Aatrex) Metribuzin (Sencor) Simazine (Princep)
	Lipid biosynthesis inhibition	Ethofumesate (Prograss)
	Protoporphyrinogen oxidase (PPO) inhibition	Flumioxazin (SureGuard)
Postemergence	Acetyl CoA Carboxylase (ACCase) enzyme inhibition	Clethodim (Envoy) Diclofop (Illoxan) Fenoxaprop-ethyl (Acclaim Extra) Fluazifop-P (Fusilade II) Sethoxydim (Vantage)
	Acetolactate synthase (ALS) enzyme inhibition	Bispyribac-sodium (Velocity) Chlorsulfuron (Corsair) Flazasulfuron (Katana) Foramsulfuron (Revolver) Imazaquin (Image) Metsulfuron (Manor) Penoxsulam (Sapphire) Rimsulfuron (TranXit) Sulfosulfuron (Certainty)

	Thiencarbazone-methyl Trifloxysulfuron (Monument)
Carotenoid biosynthesis (HPPD) inhibitors	Mesotrione (Tenacity) Topramezone (Pylex)
Enolpyruvyl Shikimate-3 Phosphate (EPSP) synthase inhibition	Glyphosate (Roundup)
Glutamine synthetase inhibition	Glufosinate (Finale)
Nucleic acid inhibition	MSMA, DSMA
Photosystem I inhibition	Diquat (Reward)
Photosystem II inhibition	Amicarbazone (Xonerate) Bentazon (Basagran) Siduron (Tupersan)
Protoporphyrinogen oxidase (PPO) inhibition	Carfentrazone-ethyl (Quicksilver) Sulfentrazone (Dismiss)
Synthetic auxin inhibition	2,4-D, dicamba, MCPP, 2,4-DP, MCPA Clopyralid (Confront) Fluroxypyr (Spotlight) Triclopyr (Turflon)

*Additional trade names are available for many products.