HERBICIDE RESISTANCE ACTION COMMITTEE

HRAC Mode of Action Classification 2024

https://hracglobal.com/tools/2024-hrac-global-herbicide-moa-classification Here access the complete herbicide MoA classification excel database.

光激活ROS Light Activation of ROS[a]

C1/C2 抑制光合作用 PS II

5 Inhibition of Photosynthesis at PS II

與D1 Ser^{264} 或His^{215}以外位點黏結

D1 Serine 264 binders (and other non-histidine 215 binders)

三嗪類 Triazines: prometryne 佈殺丹 草殺淨 普拔根 氯乃淨 草脫淨; monuron 可尊草 terbutryne 草滅淨; isoproturon 克草 methabenzthiazuron 達有龍 terbuthylazine 理有龍; lenacil 克草 terbacil 除草寧 phenmedipham 撲賽草; chloranocryl/dicryl 滅必淨 amicarbazone 得樂滅 chloridazon/pyrazon

尿素 Ureas: metamitron 菲殺淨

尿嘧啶 Uracils

氨基甲酸苯酯 Phenylcarbamates

醯胺 Amides

三嗪酮 Triazinones

E 抑制原紫質原氧化酶 PPO

14 Inhibition of Protoporphyrinogen Oxidase (PPO)

苯基亞胺 N-Phenylimides: epyrifenacil 布芬草 殺芬草 cinidon-ethyl; flumioxazin 必芬諾 flumiclorac-pentyl 乙基派芬草 fluthiacet; pyraclonil

聯苯醚 Diphenyl ethers: tiafenacil 亞喜芬 pentoxazone 乙基克繁草 lactofen

苯基三唑啉酮 N-Phenyltriazolinones: 復祿芬 sulfentrazone fomesafen 樂滅草 oxadiargyl

苯基噁二唑酮 N-Phenyl-oxadiazolones: 本達隆 bentazon 必汰草 pyridate

C3 抑制光合作用 PS II

6 Inhibition of Photosynthesis at PS II

與D1 His^{215}以外位點黏結

D1 Histidine 215 binders

腈類 Nitriles 亦為解偶聯劑 also uncouplers: bromoxynil ioxynil

F1. 抑制八氫番茄紅素去飽和酶 PDS

12 Inhibition of Phytoene Desaturase (PDS)

苯基雜環 N-Phenyl heterocycles: picolinafen beflubutamid

聯苯雜環 Diphenyl heterocycles: norflurazon diflufenican

苯基醚 Phenylethers: fluridone 福瑞達 flurochloridone 氟草敏 flutamone

F2. 抑制4-羥基苯丙酮酸加雙氧酶

27 Inhibition of Hydroxyphenyl Pyruvate Dioxygenase (HPPD)

三酮 Triketones: benzobicyclon tolpyralate topramezone bicyclopyrone mesotrione tembotrione

吡唑 Pyrazoles: pyrazolynate benzofenap 普芬草 sulcotrione isoxaflutole

S 抑制茄基焦磷酸合成酶(SDS)

32 Inhibition of Solanesyl Diphosphate Synthase (SDPS)

T 抑制尿黑酸茄基轉移酶(HST)

33 Inhibition of Homogentisate Solanesyltransferase (HST)

pyrasulfotole aclonifen cyclopyrimorate

D PS I 電子轉向

22 PS I Electron Diversion

双吡啶 Pyridiniums: 太旱特 Diquat 巴拉刈 Paraquat

F4. 抑制脫氧木酮糖-5-磷酸合成酶

13 Inhibition of Deoxy-D-Xylulose Phosphate Synthase (DXPS)

異噁唑烷酮類 Isoxazolidinones: pixlozone 可滅蹤 Clomazone

H 抑制麩醯胺合成酶

10 Inhibition of Glutamine Synthetase (GS)

次膦酸類 Phosphinic acids: 固殺草 草銨膦 Glufosinate-ammonium 畢拉草 Bialaphos/bilanafos

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細胞代謝 Cellular Metabolism

B 抑制側鏈胺基酸合成

2 Inhibition of Acetolactate Synthase (ALS)

咪唑啉酮 Imidazolinones: imazamethabenz imazamox imazaquin imazapic imazethapyr

磺醯尿素(34) Sulfonylureas: foramsulfuron 亞速隆 azimsulfuron 西速隆 metazosulfuron 環磺隆 prosulfuron 百速隆 iodosulfuron 伏速隆 nicosulfuron 合速隆 mesosulfuron amidosulfuron orthosulfamuron

三唑啉並嘧啶-第二型 Triazolopyrimidines – type 1: thifensulfuron primisulfuron sulfometuron metsulfuron triasulfuron tribenuron tritosulfuron ethametsulfuron rimsulfuron

硫代苯甲酸嘧啶 Pyrimidinylbenzoates: sulfosulfuron propyrisulfuron trifloxysulfuron triflusulfuron 派伏利 pyriminobac- 平速爛 flucarbazone pyrithiobac pyroxsulam thiencarbazone propoxycarbazone pyribenzoxim pyrimisulfan bispyribac- flumetsulam florasulam metosulam chlorimuron flucetosulfuron

三唑嘧啶-第二型 Triazolopyrimidine – type 2

三唑啉酮 Triazolinones

磺醯胺基甲酸鹽 Sulfonylaminocarbonyltriazolinones: 磺草唑 thiencarbazone-methyl 丙苯磺隆 propoxycarbazone-Na 甲氧磺草胺 pyrimisulfan 雙吡磺草胺 bispyribac-Na 氟胺磺隆 flucarbazone-Na 嘧苯胺磺隆 pyrimisulfan 磺酰磺隆 sulfosulfuron 甲氧磺隆 metosulam

磺酰胺苯甲酰胺類 Sulfonanilides 硫代苯甲醯胺

K3/N 抑制超長鏈脂肪酸生合成

15 Inhibition of Very Long-Chain Fatty Acid Synthesis (VLCFA)

氯乙醯胺 α-Chloroacetamides: 丁基拉草 acetochlor 丁草胺 butachlor 拉草 alachlor 莫多草 metolachlor 滅草胺 propisochlor dimethachlor

硫代乙醯胺 α-Thioacetamides: 哌嗪基甲酸鹽 Azolylcarboxamides

氧乙醯胺 α-Oxyacetamides: 苯并呋喃 Benzofuranes 異噁唑啉 Isoxazolines 環氧烷 Oxiranes: benfuresate 呋喃丹 carbofuran 益覆滅 ethofumesate 稻得壯 dimepiperate esprocarb 艾繁草 ipfencarbazone

K3/N 硫代胺基甲酸鹽

Thiocarbamates: peroxamid 沐草滅 pethoxamid 普拉草 dimethenamid 萬隆 prethiachlor 殺丹 cycloate 欣克草 butylate 莫多草 vernolate 雷蒙得 pebulate 丙硫克百威 benthiocarb 滅芬草 EPTC 愛落殺 molinate 三唑磺草胺 tri-allate 艾繁草 esprocarb 雷蒙得 orbencarb 丙草胺 propisochlor 二甲吩草胺 dimethachlor 氟噻草胺 flufenacet 氟噻唑胺 fentrazamide 茵達靈 indanofan 苯噻草胺 cafenstrole 苯噻酰草胺 fenoxasulfone 吡唑草胺 pyroxasulfone

L. 抑制纖維素合成酶

29 Inhibition of Cellulose Synthesis

烷基嗪類 Alkylazines: indaziflam 腈類 Nitriles: chlorthiamid 二氯苯腈 dichlobenil 三唑醯胺 isoxaben

A 抑制乙醯輔酶A羧化酶 ACCase

1 Inhibition of Acetyl CoA Carboxylase (ACCase)

環己烯酮類 Cyclohexanediones: 剋草同 clethodim 得殺草 tralkoxydim 環殺草 cycloxydim 西殺草 sethoxydim profoxydim 甲基合氯氟 clodinafop 芬殺草 metamifop 卡基賽伏草 fenthiaprop 快伏草 quizalofop-ethyl 伏寄普 fluazifop-butyl 二甲吡醚 diclofop-methyl

芳氧基丙酸類 Aryloxyphenoxypropionates: pinoxaden

Q 抑制脂肪酸硫酯酶

30 Inhibition of Fatty Acid Thioesterase (FAT)

苯基醚 Benzyl ethers: cinmethylin oxaziclomefone 噁芬諾成分 bromobutide methiozolin

R 抑制絲胺酸/蘇胺酸蛋白磷酸酶

31 Inhibition of Serine Threonine Protein Phosphatase (STPP)

endothal

G 抑制內烯醇丙酮基莽草素磷酸合成酶

9 Inhibition of Enolpyruvyl Shikimate Phosphate Synthase (EPSPS)

甘胺酸類 嘉磷塞 glyphosate

I 抑制二氫蝶呤合成酶 DHP

18 Inhibition of Dihydropteroate Synthase (DHPS)

亞速爛 Asulam 氨基甲酸鹽

抑制二氫乳清酸脫氫酶

28 Inhibition of Dihydroorotate Dehydrogenase (DHODH)

tetflupyrolimet

細胞分裂/生長 Cell Division and Growth

K1. 抑制有絲分裂微管組合

3 Inhibition of Microtubule Assembly

二硝基苯胺 Dinitroanilines: 二福林 trifluralin 比達寧 butralin 倍尼芬 benefin 歐拉靈 oryzalin 施得圃 pendimethalin 伐爾利 ethalfluralin

吡啶 Pyridines: thiazopyr 太硫草 dithiopyr

亞磷醯胺 Phosphoroamidates: butamifos DMPA 大克草 propyzamide 普拿磨草 pronamide

O 生長素 IAA 類似物

4 Auxin Mimics

氯吡啶甲酸酯類 6-Chloropicolinates: 苯氧基羧酸 Phenoxycarboxylates: 2,4-D 二,四-地 2,4-DB 克普草 dichlorprop 2,4,5-T 畢克草 mecoprop 畢克燼 加撲草 MCPB

吡啶氧基羧酸 Pyridyloxycarboxylates: 芳基吡啶甲酸酯類 6-Arylpicolinates: 脫禾草 MCPA 畢克燼 Picloram 氟氯比 Fluroxypyr 比拉芬 Florpyrauxifen 三氯比 Triclopyr 太克草 halauxifen 氨基比 aminocyclopyrachlor 苯甲酸類 Benzoates: 克爛本 Chloramben 快克草 Quinclorac

喹啉羧酸類 Quinolinecarboxylates: quinmerac benzolin-ethyl

K2 抑制微管組織化

23 Inhibition of Microtubule Organization

氨基甲酸鹽 Carbamates: chlorpropham barban carbetamide

M 解偶聯

24 Uncouplers

二硝基酚 Dinitrophenols: DNOC 達諾殺 Dinoseb

P IAA運送抑制

19 Auxin Transport Inhibitors

芳基羧酸鹽 Arylcarboxylates: 納得爛 Naptalam diflufenzopyr

HRAC	Legacy HRAC	Mode of Action
1	A	Inhibition of Acetyl CoA Carboxylase (ACCase)
2	D	Inhibition of Acetolactate Synthase (ALS)
3	K1	Inhibition of microtubule assembly
4	O	Auxin mimics
5	C1,2	Inhibition of Photosynthesis at PS II - D1 Serine 264 binders (and other non-histidine 215 binders)
6	C3	Inhibition of Photosynthesis at PS II – D1 Histidine 215 binders
9	G	Inhibition of Enolpyruvyl Shikimate Phosphate Synthase (EPSPS)
10	H	Inhibition of Glutamine Synthetase (GS)
12	F1	Inhibition of Phytoene Desaturase (PDS)
13	F4	Inhibition of Deoxy-D-Xylulose Phosphate Synthase (DXPS)
14	E	Inhibition of Protoporphyrinogen Oxidase (PPO)
15	K3	Inhibition of Very Long-Chain Fatty Acid Synthesis (VLCFA)
18	I	Inhibition of Dihydropteroate Synthase (DHPS)
19	P	Auxin transport inhibitors
22	D	PS I Electron Diversion
23	K2	Inhibition of microtubule organization
24	M	Uncouplers
27	F2	Inhibition of Hydroxyphenyl Pyruvate Dioxygenase (HPPD)
28	none	Inhibition of Dihydroorotate Dehydrogenase (DHODH)
29	L	Inhibition of cellulose synthesis
30	Q	Inhibition of Fatty Acid Thioesterase (FAT)
31	R	Inhibition of Serine Threonine Protein Phosphatase (STPP)
32	S	Inhibition of Solanesyl Diphosphate Synthase (SDPS)
33	T	Inhibition of Homogentisate Solanesyltransferase (HST)
Ø	Z	Unknown mode of action

Z 未知作用機制

Ø Unknown Mode of Action

暫時標靶 Putative target (FRAC) squalene epoxidase: pyributicarb (FRAC G4)

多點機制 multisite herbicides: DSMA 甲基砷酸鈉 DSMA 王酸 Petarsonic acid

尚待結論 herbicides with inconclusive MoA data: amitrol 蔡普草 etobenzanid bensulide 滅落脫 fosamine

* Reactive oxygen species

① Indicates pro-herbicide

② HRAC's recommendation is not to include a chemical family name when there is one active in the family. Actives without chemical family names are indicated with a white background

③ New actives which are still in the process of registration at the time of release of the current poster version

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