

- Eficiența scăzută la erbicidare
- Transmiterea rezistenței la buruieni

AGRO FLASH no. 16

Eficiența scăzută la erbicide și transmiterea rezistenței la buruieni

În ultimii ani tot auzim de eficiența scăzută a erbicidelor sau de rezistența buruienilor la erbicide. **Astăzi (23.09.22), în lume sunt 170 de specii de plante rezistente la erbicide ALS, 65 specii monocotiledonate și 105 dicotiledonate.**

Care este motivul care a determinat această rezistență?

Substanțele active prezentate în Tabelul 1 au în comun un **singur mod de acțiune, inhibitori ALS** (inhibă procesul de sinteză al aminoacizilor cu lanț ramificat), Acetolactate Synthase (ALS) sau Inhibitori Acetohydroxy Acid Synthase (AHAS).

Tab.1 Substanțe active cu același mod de acțiune (ALS)

| Imidazolinones | |
|------------------------|----------------------|
| imazamethabenz-methyl | |
| imazamox | |
| imazapic | |
| imazapyr | |
| imazaquin | |
| imazethapyr | |
| Pyrimidinyl benzoates | |
| bispyribac-sodium | |
| pyribenzoxim | |
| pyriftalid | |
| pyriminobac-methyl | |
| pyrithiobac-sodium | |
| Sulfonylureas | |
| amidosulfuron | metsulfuron-methyl |
| azimsulfuron | nicosulfuron |
| bensulfuron-methyl | orthosulfamuron |
| chlorimuron-ethyl | orthosulfamuron |
| chlorsulfuron | oxasulfuron |
| cinosulfuron | primisulfuron-methyl |
| cyclosulfamuron | prosulfuron |
| ethametsulfuron-methyl | pyrazosulfuron-ethyl |
| ethoxysulfuron | rimsulfuron |

| flazasulfuron | sulfometuron-methyl |
|-----------------------------|-----------------------|
| flucetosulfuron | sulfosulfuron |
| flupyrsulfuron-methyl-Na | thifensulfuron-methyl |
| foramsulfuron | triasulfuron |
| halosulfuron-methyl | tribenuron-methyl |
| imazosulfuron | trifloxysulfuron-Na |
| iodosulfuron-methyl-Na | triflusulfuron-methyl |
| mesosulfuron-methyl | triofensulfuron |
| metazosulfuron | tritosulfuron |
| Triazolinones | |
| flucarbazone-Na | |
| procarbazone-Na | |
| propoxycarbazone-Na | |
| thiencarbazone-methyl | |
| Triazolopyrimidine - Type 1 | |
| cloransulam-methyl | |
| diclosulam | |
| florasulam | |
| flumetsulam | |
| metosulam | |
| penoxsulam | |
| pyroxsulam | |

Cum se întâmplă rezistența?

Orice populație de buruieni în mod natural conține plante rezistente sau care dobândesc rezistență la erbicide.

Cele mai multe buruieni (170), sunt rezistente la erbicidele din grupa (B sau 2) din sistemul HRAC sau WSSA.

Datorită folosirii unui singur mod de acțiune (ALS-acetolactat sinteză), pe o perioadă îndelungată, buruienile au început să dezvolte rezistență la aceste erbicide. Având în vedere că în România este modul de acțiune cel mai folosit trebuie să ne așteptăm la eficiențe tot mai scăzute a erbicidelor care au acest mod de acțiune.



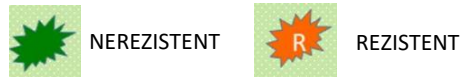
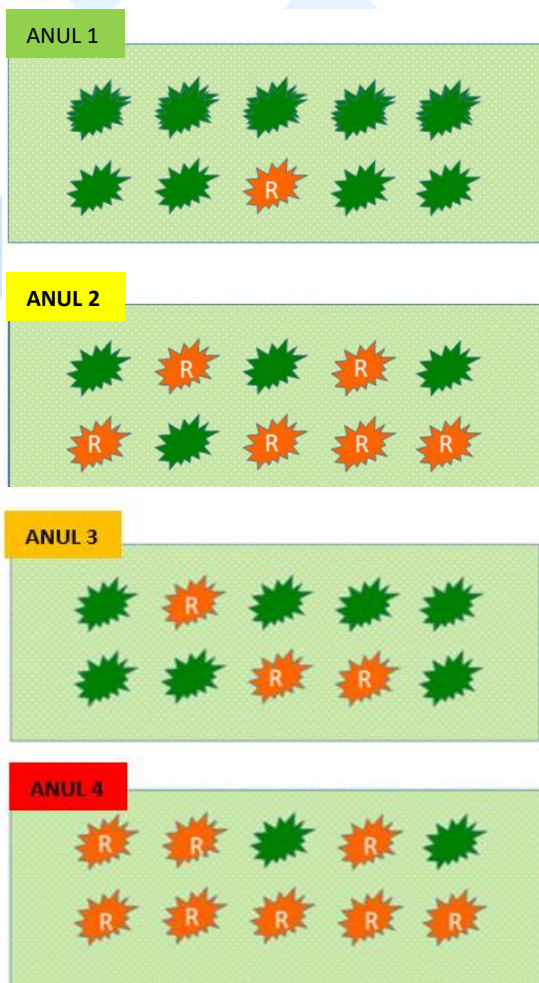


Cum se transmite rezistența?

Buruienile pot dobândi rezistență la erbicide în mod natural prin indivizi rezistenți, dar și prin indivizi care dezvoltă rezistență la un anumit mod de acțiune (Exemplu: ALS), care este utilizat foarte frecvent și de foarte mult timp. O dată ce un individ dezvoltă rezistență, el va transmite această rezistență la maturitate prin semințe și acest ciclu se va repeta an de an până când buruiana rezistentă va fi predominantă într-o parcelă sau într-un areal mai mare (Fig.1).

Unele buruieni au dobândit rezistență încrucișată, această rezistență este dată de un mecanism mai complex ce permite anumitor specii să supraviețuiască chiar dacă erbicidarea s-a realizat cu erbicide cu moduri diferite de acțiune (din diferite grupe chimice).

Fig.1 Transmiterea rezistenței



Pentru a preveni aceste situații trebuie respectate mai multe aspecte:

-rotația modurilor de acțiune a erbicidelor (folosirea de substanțe active din diferite grupe, non ALS, Grupa B).

-aplicarea erbicidului la stadiul corespunzător al buruienilor.

-utilizarea dozei de erbicid recomandată de producător pentru o eficiență ridicată, pentru a evita producerea semințelor de buruieni.

-respectarea rotației culturilor.

-utilizarea covoarelor vegetale (culturi de acoperire), pentru a reduce presiunea buruienilor dar și pentru alte beneficii (vezi Agro Flash Nr.6).

-toaletați parcela pentru a evita infestarea câmpurilor vecine.

-evitarea transferului mecanic al semințelor de la un câmp la altul prin intermediul utilajelor agricole.

Soufflet Agro România recomandă următoarea schemă de erbicidare la cereale Preemergent (BBCH 00) sau postemergent în stadiul de o frunză până la începutul înfrățirii (BBCH 11-21).

FLASH 500 SC

diflufenican 500 g/l

0,2 l/ha

ACTIVUS 400 SC

pendimetalin 400 g/l

1,8 l/ha

FLUENT 500 SC

flufenacet 500 g/l

0,2 l/ha

Avantaje:

-Limitarea apariției rezistenței la erbicide.

-Flexibilitate a condițiilor de aplicare.

-Preemergent BBCH 00 - Postemergent BBCH 11-21.

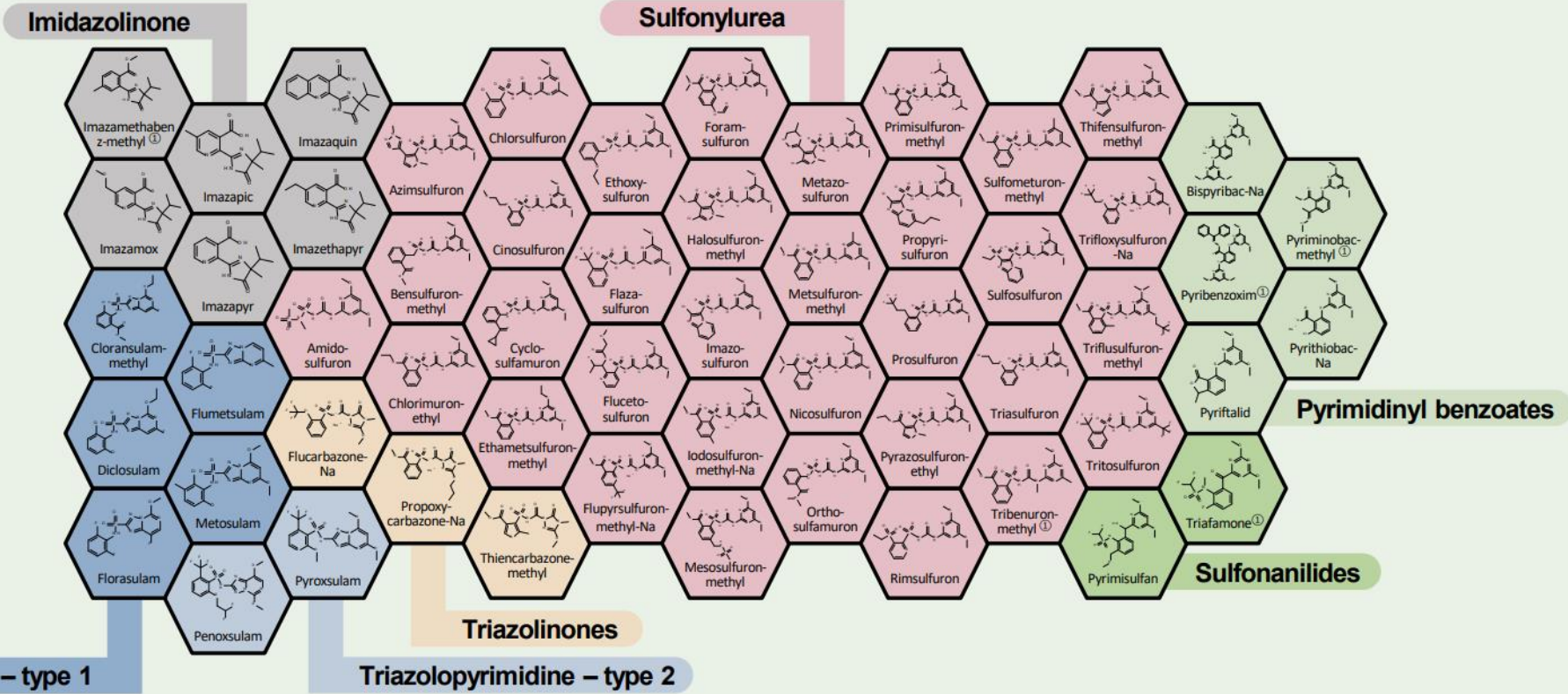
Eficacitate pe buruieni mono- și dicotiledonate.

Gestionarea răsării eșalonate a buruienilor

Atașat Anexa 1 (CLASIFICAREA ERBICIDELOR ÎN FUNCȚIE DE MODUL DE ACȚIUNE).

Cellular Metabolism

2 Inhibition of Acetolactate Synthase



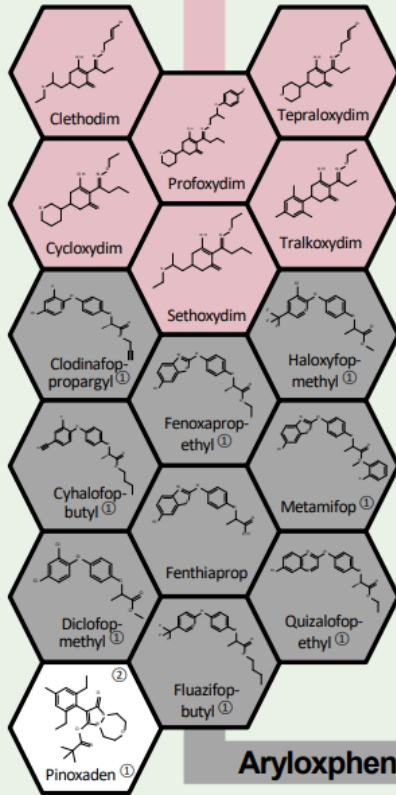
Cellular Metabolism

1 Inhibition of Acetyl CoA Carboxylase

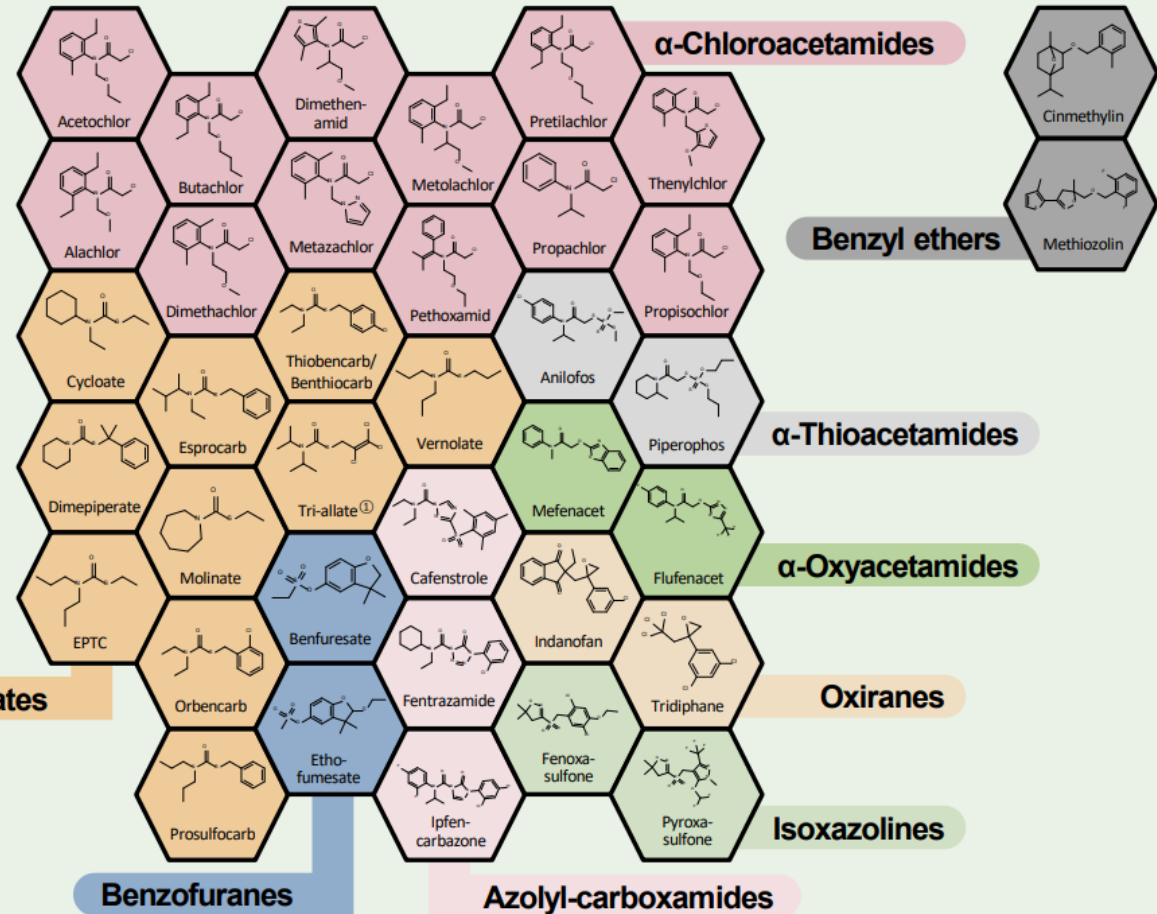
15 Inhibition of Very Long-Chain Fatty Acid Synthesis

30 Inhibition of Fatty Acid Thioesterase

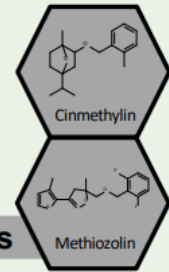
Cyclohexanediones



Aryloxyphenoxy-propionates



α -Chloroacetamides



Benzyl ethers

α -Thioacetamides

α -Oxyacetamides

Thiocarbamates

Oxiranes

Benzofuranes

Azolyl-carboxamides

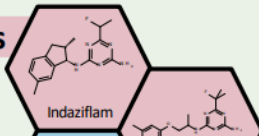
Isoxazolines

Cellular Metabolism

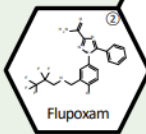
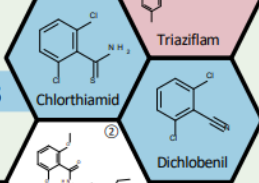
29

Inhibition of Cellulose Synthesis

Alkylazines

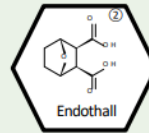


Nitriles



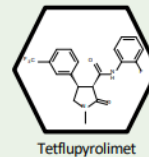
31

Inhibition of Serine Threonine Protein Phosphatase



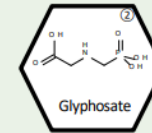
28

Inhibition of Dihydroorotate Dehydrogenase



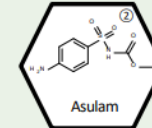
9

Inhibition of Enolpyruvyl Shikimate Phosphate Synthase



18

Inhibition of Dihydropteroate Synthase

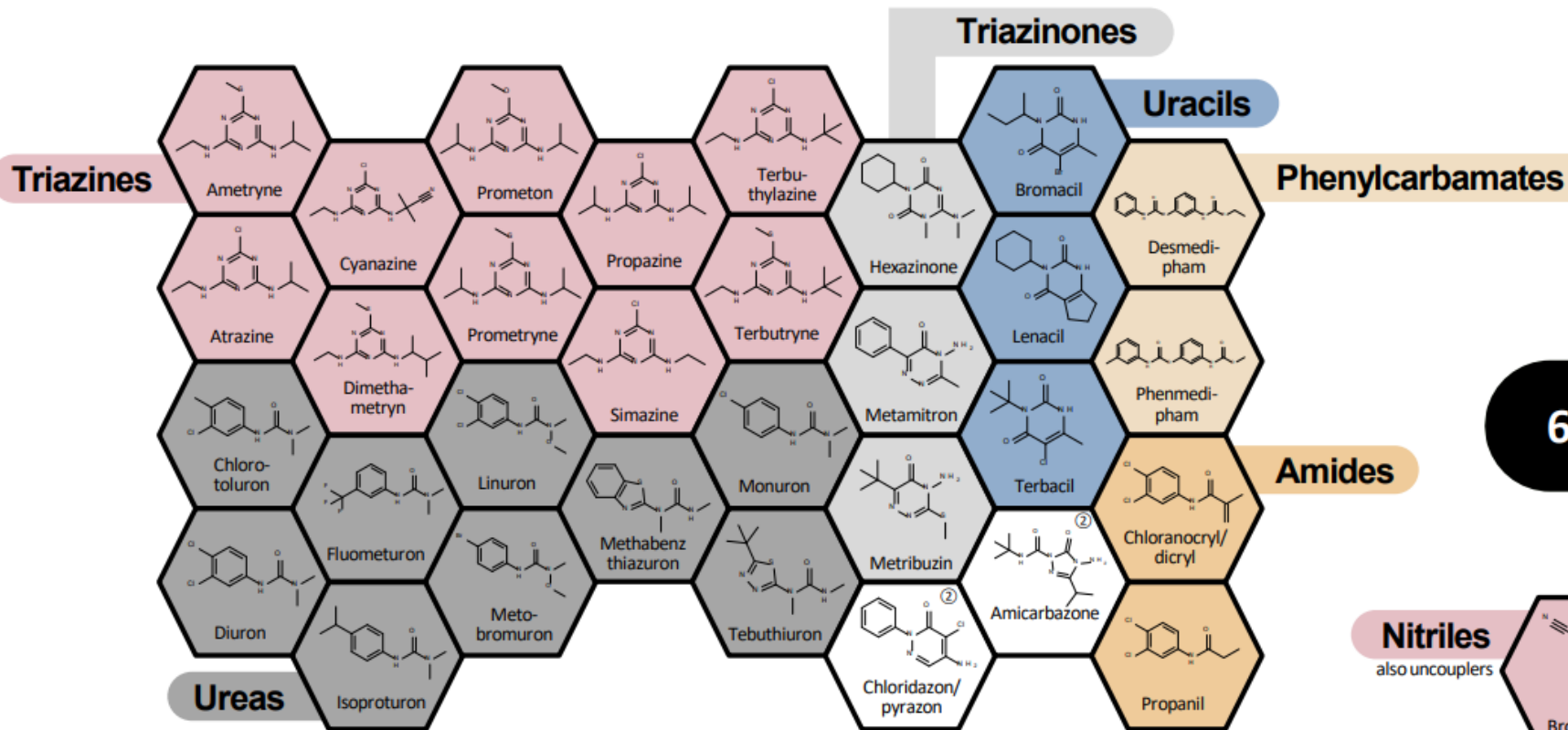


Light Activation of ROS^a

Inhibition of Photosynthesis at PS II

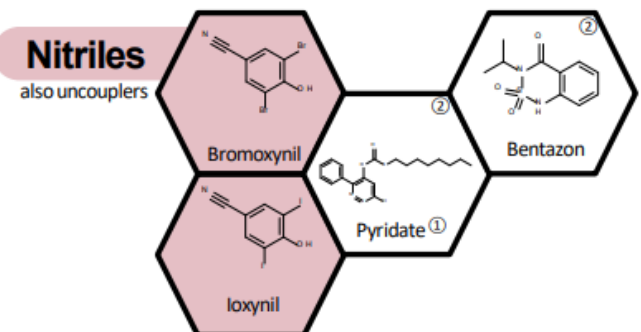
5

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



6

D₁ Histidine 215 binders

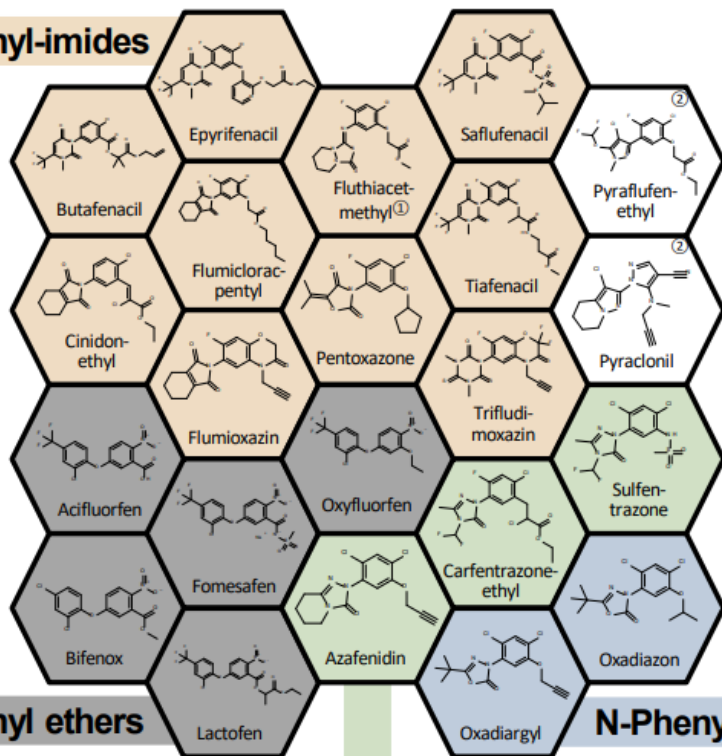


Light Activation of ROS^a

14

Inhibition of Protoporphyrinogen Oxidase

N-Phenyl-imides



Diphenyl ethers

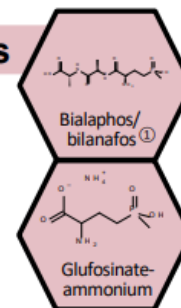
N-Phenyl-triazolinones

N-Phenyl-oxadiazolones

10

Inhibition of Glutamine Synthetase

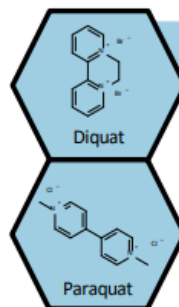
Phosphinic acids



22

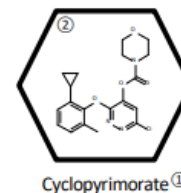
PS I Electron Diversion

Pyridiniums



33

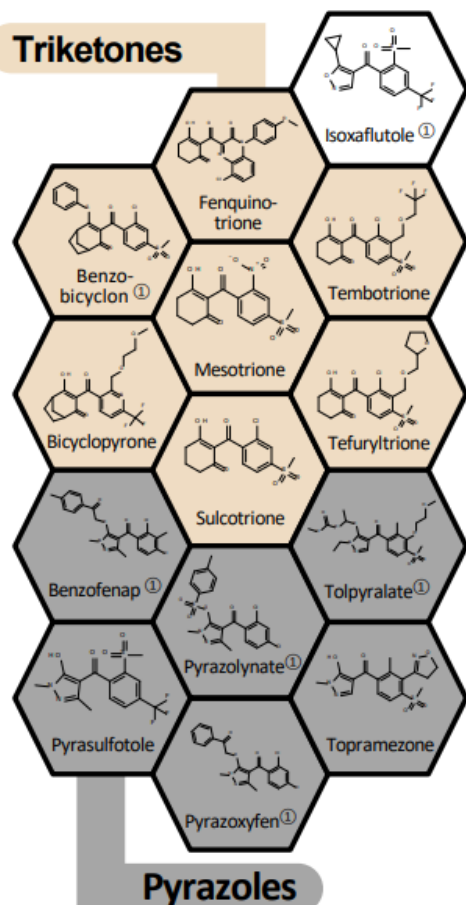
Inhibition of Homogentisate Solanesyltransferase



Light Activation of ROS^a

27

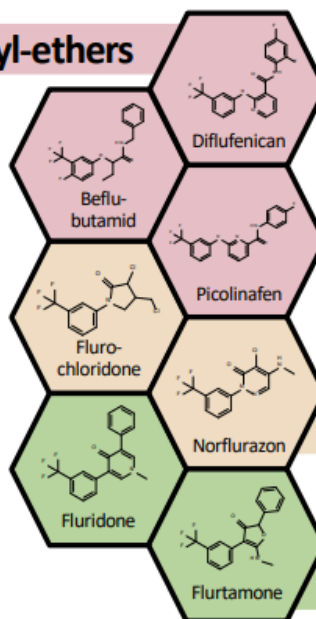
Inhibition of Hydroxyphenyl Pyruvate Dioxygenase



12

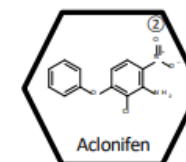
Inhibition of Phytoene Desaturase

Phenyl-ethers



32

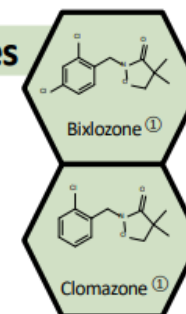
Inhibition of Solanesyl Diphosphate Synthase



13

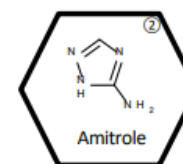
Inhibition of Deoxy-D-Xylulose Phosphate Synthase

Isoxazolidinones



34

Inhibition of Lycopene Cyclase



^a 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

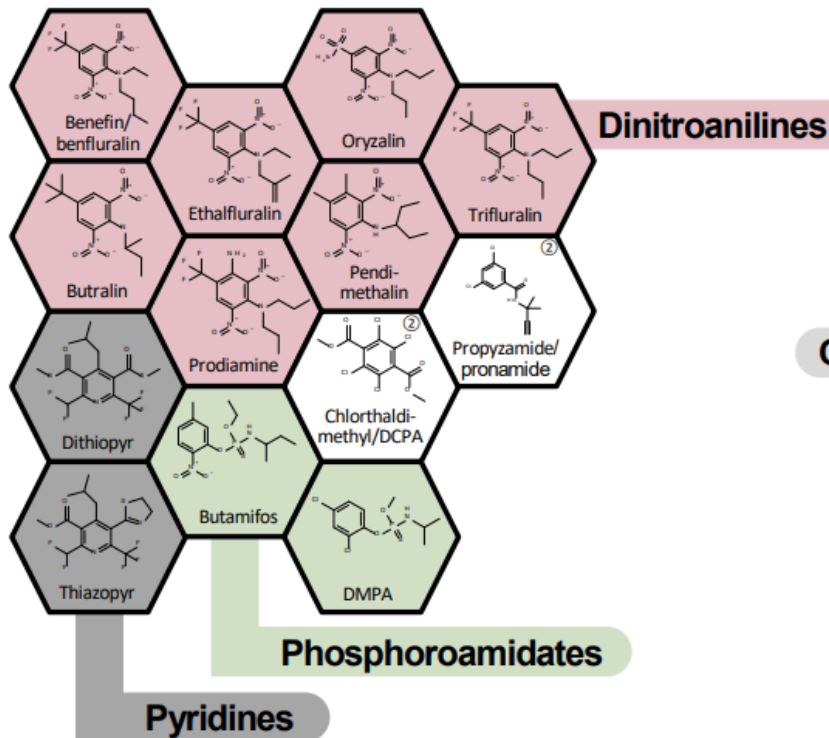
Cell Division and Growth

3

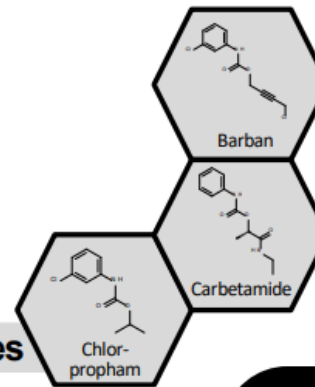
Inhibition of
Microtubule Assembly

23

Inhibition of Microtubule
Organization



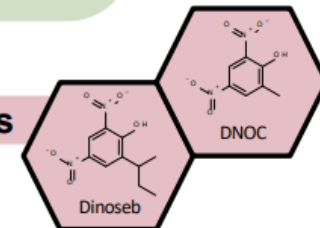
Carbamates



24

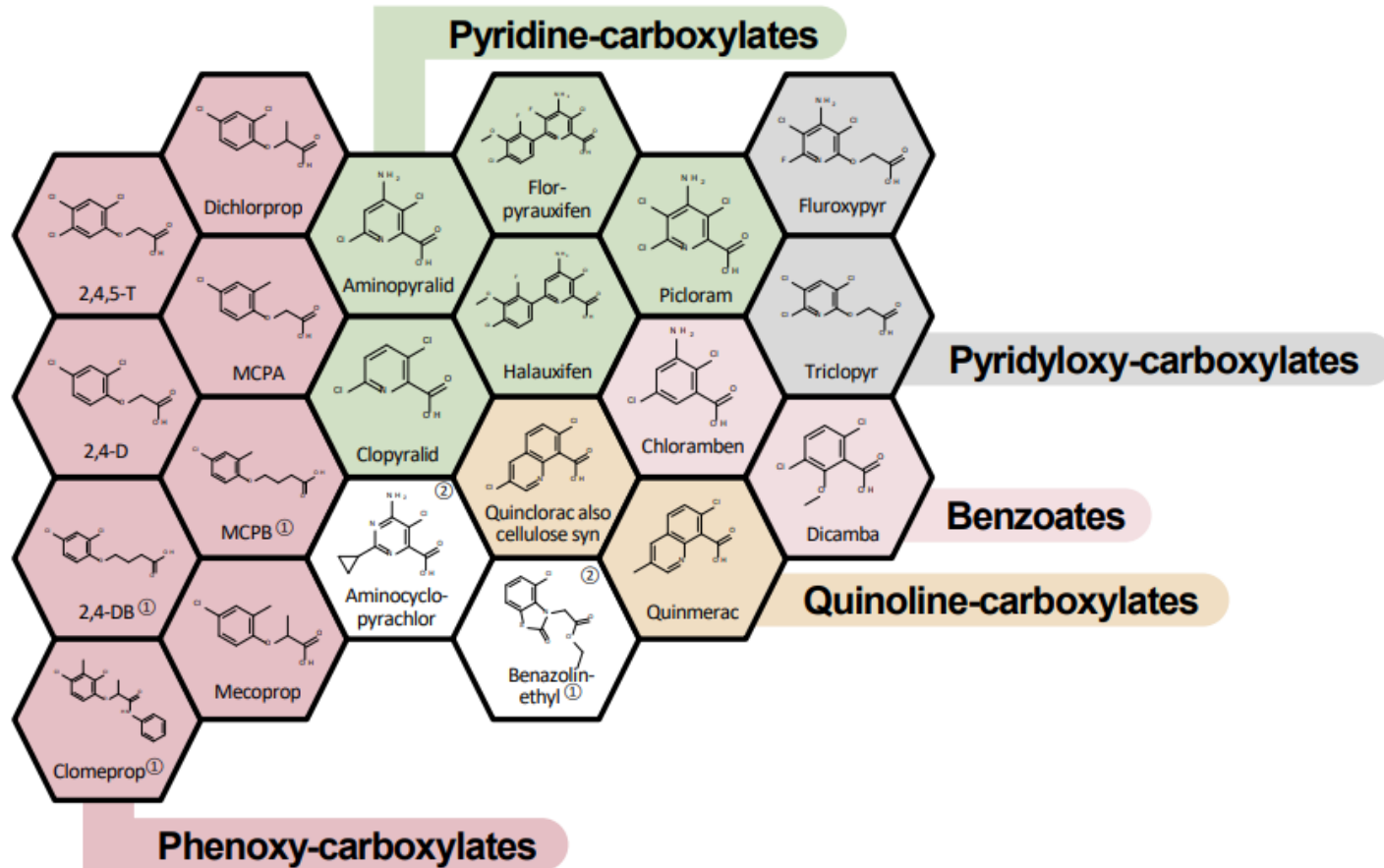
Uncouplers

Dinitrophenols



Cell Division and Growth

4 Auxin Mimics



Cell Division and Growth

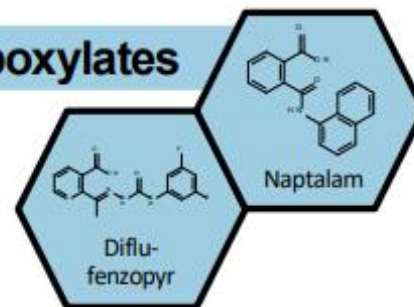
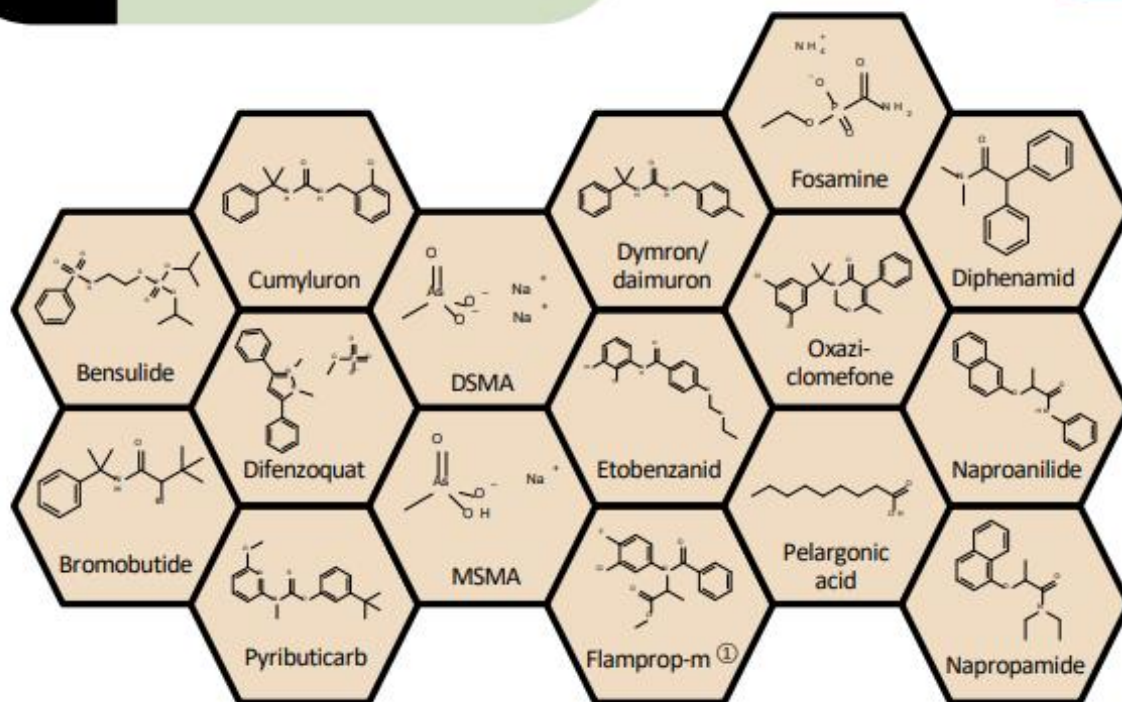
19

Auxin Transport Inhibitors

∅

Unknown Mode of Action

Aryl-carboxylates



| HRAC | Legacy HRAC | |
|------|-------------|--|
| 1 | A | Inhibition of ACCase |
| 2 | B | Inhibition of ALS |
| 3 | K1 | Inhibition of microtubule assembly |
| 4 | O | Auxin mimics |
| 5 | C1,2 | Inhibition of photosynthesis PS II – Serine 264 |
| 6 | C3 | Inhibition of photosynthesis PS II – Histidine 215 |
| 9 | G | Inhibition of EPSP synthase |
| 10 | H | Inhibition of glutamine synthetase |
| 12 | F1 | Inhibition of PDS |
| 13 | F4 | Inhibition of DOXP synthase |
| 14 | E | Inhibition of PPO |
| 15 | K3 | Inhibition of VLCFAs |
| 18 | I | DHP inhibition |

| HRAC | Legacy HRAC | |
|------|-------------|--|
| 19 | P | Auxin transport inhibitors |
| 22 | D | PS I electron diversion |
| 23 | K2 | Inhibition of microtubule organization |
| 24 | M | Uncouplers |
| 27 | F2 | Inhibition of HPPD |
| 28 | none | Inhibition of dihydroorotate dehydrogenase |
| 29 | L | Inhibition of cellulose synthesis |
| 30 | Q | Inhibition of fatty acid thioesterase |
| 31 | R | Inhibition of serine threonine protein phosphatase |
| 32 | S | Inhibition of solanesyl diphosphate synthase |
| 33 | T | Inhibition of homogentisate solanesyltransferase |
| 34 | F3 | Inhibition of lycopene cyclase |
| Ø | Z | Unknown mode of action |