

ALS Inhibiting herbicides

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PLNT 4013
Principles of Weed Science

Terms to remember

- ▶ photosynthesis (food)
- ▶ respiration (energy)
- ▶ amino acids (proteins/growth)
- ▶ lipids (cell membranes)
- ▶ pigments (energy/light capture)
- ▶ mitosis (cell division)

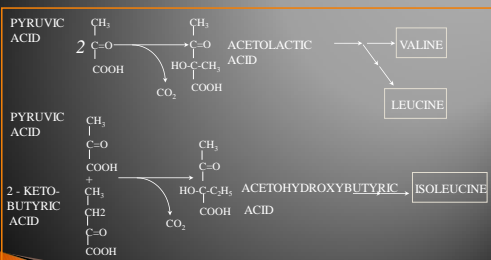
ALS Inhibitor Discovery

- ▶ Sulfonylurea and imidazolinone herbicides were discovered independently in the mid-1970's.
- ▶ Triazolopyrimidine herbicides were discovered in the 1980s by manipulations of known active chemistry.
- ▶ Pyrimidinyl thiobenzoate herbicides were discovered in the mid-1980's in Japan.

ALS Inhibitor Mode-Of-Action

- ▶ Inhibits plant growth within 2h after treatment.
- ▶ Growth inhibition reversed by addition of branched-chain AA's.

Reactions Catalyzed by Acetolactate Synthase Leading to Branched Chain Amino Acids



ALS Inhibitors

- ▶ Persistence can be short or long
 - High pH - sulfonylurea rotation restriction is long
 - Low pH - imidazolinone rotation restriction is long
- ▶ Adsorption is low
- ▶ Leaching is low to moderate
- ▶ Microbial degradation is moderate to high
- ▶ Chemical decomposition is very high and decreases as soil pH increases.
- ▶ Photodecomposition is low

Sulfonylureas, Imidizolinones

- ▶ Most of these herbicides have soil and foliar activity
- ▶ Systemically translocated in plants
- ▶ Soil activity herbicide-dependent
- ▶ Generally, low use-rate herbicides

ALS-Inhibitor Resistant Crops – none are transgenic

| |
|--------------|
| IR Corn |
| IT Corn |
| ST Soybeans |
| IR Canola |
| IR Wheat |
| IR Rice |
| IR Sunflower |
| ST Cotton |
| ST Sunflower |

ALS Inhibitors

- ▶ Prevent synthesis of certain amino acids
- ▶ produced by plants but not animals
- ▶ Excellent foliar and root absorption
- ▶ Broad weed spectrum
- ▶ Translocated to shoot and root new growth
- ▶ Plants stop growing shortly after application
- ▶ Plant death may be slow

ALS Inhibitor Symptomology

- ▶ Rapid inhibition of root and shoot growth
- ▶ Vein reddening
- ▶ Leaf chlorosis
- ▶ Terminal bud necrosis
- ▶ Slow whole plant necrosis (2–4 weeks)

ALS Inhibitor Symptomology

- ▶ Grass symptoms include: stunting, purple coloration, and inhibited root systems with bottle-brush appearance
- ▶ Broadleaf symptoms include: red or purple veins, yellowing of new leaves and blackened terminal growth



Chlorsulfuron



19 days after exposure

25 days after exposure

Arsenal (imazapyr)



blackberry



sweetgum

14

Arsenal (imazapyr)



Compact growth Untreated on azalea

15

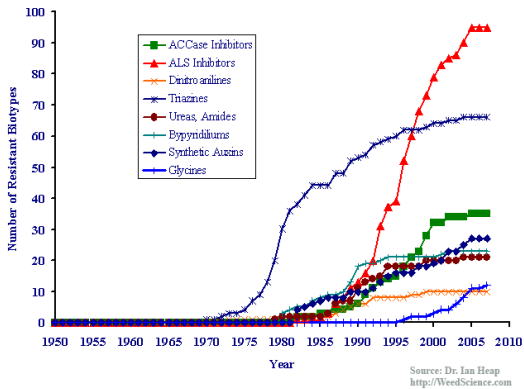
Arsenal (imazapyr)



Bunched, compact growth on dogwood and sassafras



16



Selection of ALS-Inhibitor Resistant weeds



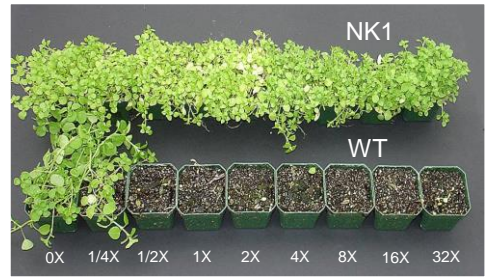
Occurs at the level of the ALS enzyme

112 species

Italian Ryegrass – ALS Herbicides?



Effect of Thifensulfuron-methyl Application Rate on Common Chickweed Control – NK1 Source – 28 DAT



Sulfonyleurea damage to soybean





Root stunting and witches broom or bottle brush symptoms

