

## Lecture

### Unknown Mode of Action – Organic Arsenicals

#### 1. General Information

Several herbicides are currently registered where the specific mode of action is not known.

#### 2. Possible Modes of Action

Energy uncoupling (ATP) has been proposed as a mode of action for the organic arsenicals, but, insufficient evidence is available to indicate any mechanisms. Rapid desiccation indicates cell membrane destruction. These herbicides are referred to as contact herbicides.

#### 3. Site of Action

Respiration process in mitochondria if this is indeed the mode of action.

#### 4. Symptoms

Following foliar application rapid chlorosis and necrosis observed.

#### 5 Herbicide Family

Organic Arsenicals		
Example	$  \begin{array}{c}  \text{O} \\     \\  \text{CH}_3 - \text{As} - \text{OH} \\    \\  \text{O}^\ominus \text{Na}^\oplus \\  \text{MSMA (MSMA/Bueno)}  \end{array}  $ $  \begin{array}{c}  \text{O} \\     \\  \text{CH}_3 - \text{As} - \text{O}^\ominus \text{Na}^\oplus \\    \\  \text{O}^\ominus \text{Na}^\oplus \\  \text{DSMA (DSMA/Ansar)}  \end{array}  $	members of this family are salts of methylarsonic acid; the common chemical nucleus is methylarsonic acid; notice the Na's in the two structures; referred to as contact herbicides
Metabolism	<u>plant</u> – conjugation <u>soil</u> – microbes degrade to arsenite half-life – 180d	

Absorption & Translocation	readily absorbed by foliage and translocated in apoplast and symplast, but symplast of greater importance; little translocation to shoots following root absorption
Selectivity	selective- not known
Herbicide Use	controls annual grasses, johnsongrass, nutsedges, cocklebur  used POST in turf (crabgrass and dallisgrass control), cotton, noncrop areas  a Ca salt formulation of methanearsonate (Calar) developed because of greater turf tolerance than DSMA; arsenicals tightly adsorbed to soil colloids; arsenical-resistant cocklebur has been reported (mechanism unknown); pasture use illegal (discuss animal toxicity problems)

## 6. General Comments

Organic arsenicals have been used for many years in cotton. Cotton is more tolerant to MSMA than to DSMA. DSMA is used only as a basal post-directed spray. MSMA can be applied post-directed and may be applied over the top as a salvage operation when cotton is 3 to 6 inches tall or up to first square.

The turfgrasses, bermudagrass, bluegrass, and zoysiagrass are very tolerant to MSMA. Do not apply to St. Augustinegrass or centipedegrass.

Organic arsenicals are of low toxicity to man and animals – having about the same toxicity, or less, as aspirin.

## 7. References

Ahrens, W. Herbicide Handbook, seventh edition. 1994. Weed Science Society of America, Champaign, IL.

Devine, M.D., S.O. Duke, and C. Fedtke. Physiology of Herbicide Action. 1993. Prentice Hall, NJ.

Stryer, L. Biochemistry – fourth edition. 1995. W.H. Freeman, NY.