Weed management in sugarcane

Dr. Calvin Odero

University of Florida

Everglades Research & Education Center

dcodero@ufl.edu

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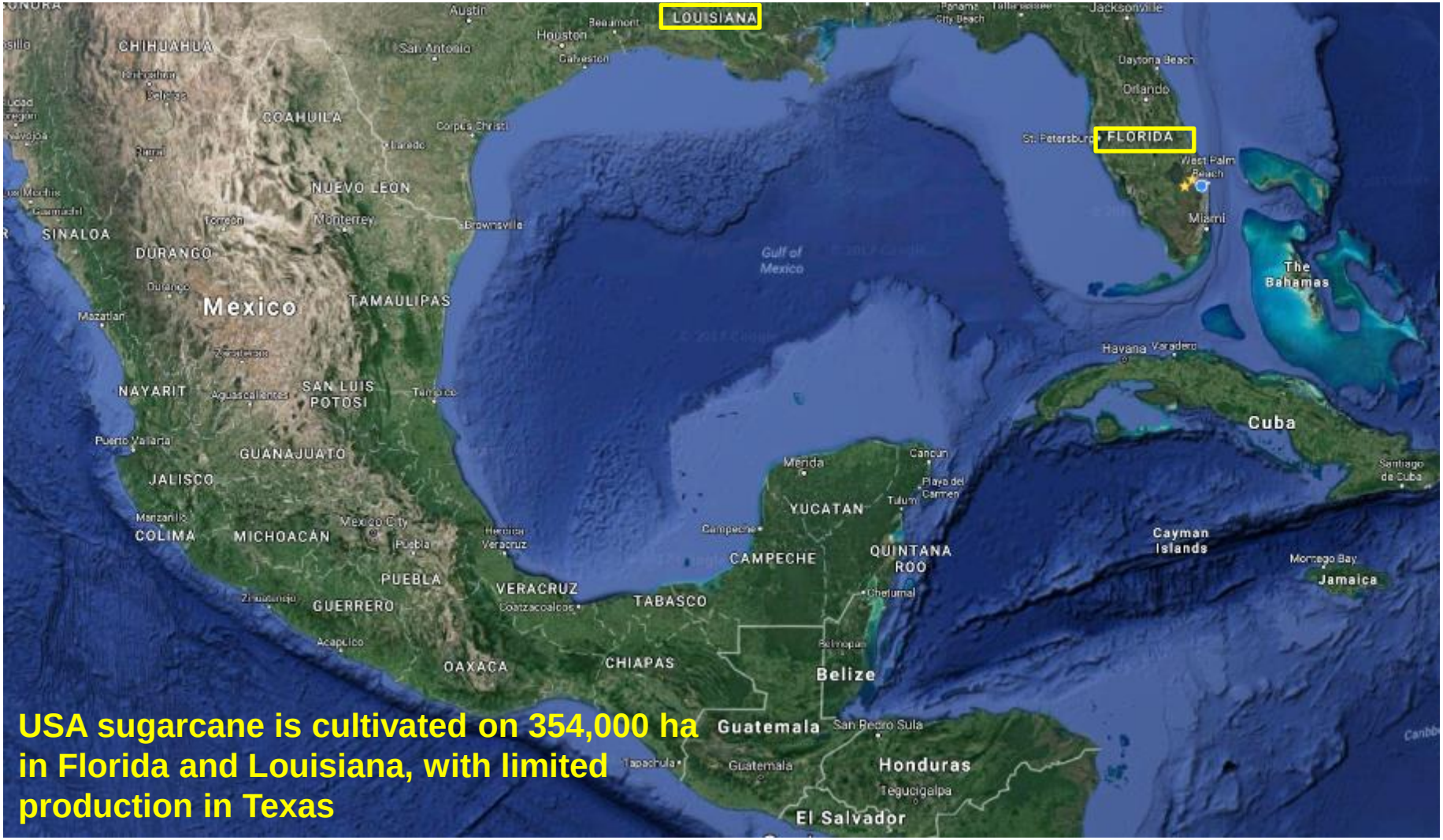
USA sugarcane production



USA sugarcane is cultivated on 354,000 ha in Florida and Louisiana, with limited production in Texas

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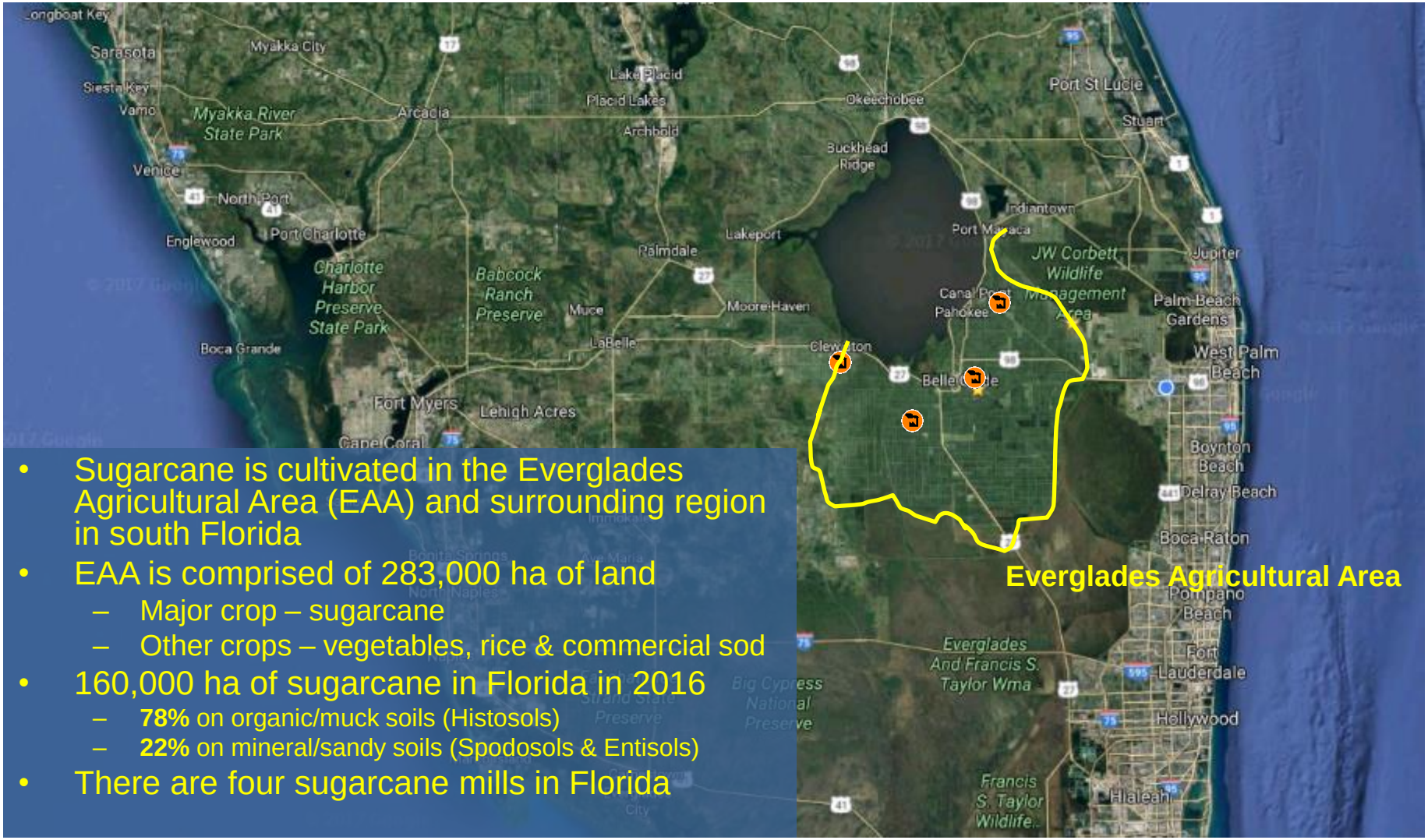
Florida sugarcane production



- Sugarcane is cultivated in the Everglades Agricultural Area (EAA) and surrounding region in south Florida
- EAA is comprised of 283,000 ha of land
  - Major crop – sugarcane
  - Other crops – vegetables, rice & commercial sod
- 160,000 ha of sugarcane in Florida in 2016
  - **78%** on organic/muck soils (Histosols)
  - **22%** on mineral/sandy soils (Spodosols & Entisols)
- There are four sugarcane mills in Florida

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EAA organic soils

- EAA is dominated by organic soils underlain by limestone rock layer
- Soils have high soil organic matter content of up to 85%
- Weed control especially with soil applied herbicides is more difficult on these soils because of
  - High cation exchange capacity, large soil microbial populations, and relatively high soil moisture and temperature often associated with herbicide adsorption and metabolism by soil microorganisms
  - These factors combine to promote rapid weed growth while binding or degrading soil-applied herbicides thus significantly reducing their efficacy

Florida sugarcane crop cycle

- Planting season: September to December
- Harvest season: mid-October to March/April
- Planting and harvesting coincides with dry season
- Planting done either
  - Following fallow period
    - Temporary rotation with different crops following final ratoon
      - Sweet corn, rice, radish, green bean, leafy green vegetables
      - Long sugarcane production cycle in combination with rotation with grass crops results in heavy pressure of mostly annual and perennial grasses
  - Successive
    - Replanting several weeks after final ratoon
      - Not recommended in fields with heavy grass pressure especially perennial grasses

Weeds in Florida sugarcane

- **Florida**→ burning fields prior harvest→ no straw→ mostly grasses and small seeded broadleaf weeds



- **Brazil**→ green harvesting→ more straw→ less grasses → mostly large seeded broadleaf weeds



Weeds in Florida sugarcane

Grasses

Most prevalent

- *Panicum dichotomiflorum*
- *Cynodon dactylon*

Others

- *Eleusine indica*
- *Digitaria ciliaris*
- *Digitaria ischaemum*
- *Dactyloctenium aegyptium*
- *Sorghum almum*
- *Pennisetum purpureum*
- *Panicum repens*

Sedges

Most prevalent

- *Cyperus esculentus*
- *Cyperus rotundus*


Cynodon dactylon


Panicum dichotomiflorum

Weeds in Florida sugarcane

Most prevalent broadleaf weeds

- *Chenopodium album*
- *Amaranthus spinosus*

Others

- *Ambrosia artemisiifolia*
- *Portulaca oleracea*
- *Ipomea spp.*
- *Senna accidentalis*
- *Senna obtusifolia*
- *Solanum americanum*
- *Alternanthera philoxeroides*


Chenopodium album


Amaranthus spinosus

Florida broadleaf weed species are suitable food sources and oviposition sites for *Diaprepes abbreviatus*; however, sugarcane is generally more preferred for oviposition

Odero et al. (2013) J. Ento. Sci. 48:81-89

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Weed management in Florida sugarcane

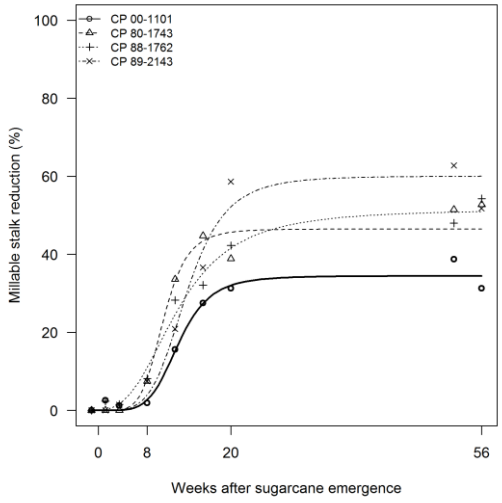
- Major cost associated with sugarcane production
- **Weed control is most critical early in the season prior to sugarcane canopy closure over the row middles**
- Weeds that mature and produce seed become
  - Sources of seed bank replenishment and re-infestation in subsequent years

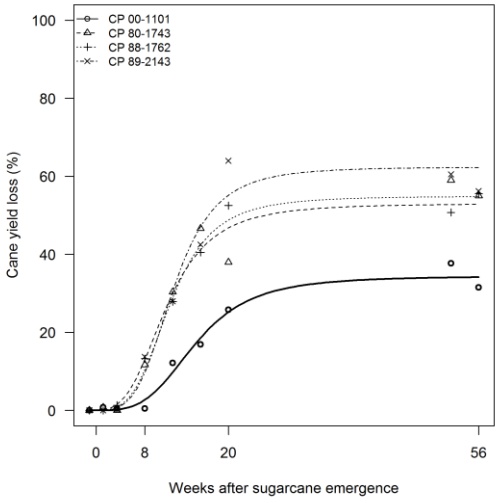
Weed Technology 2016 30:13–20

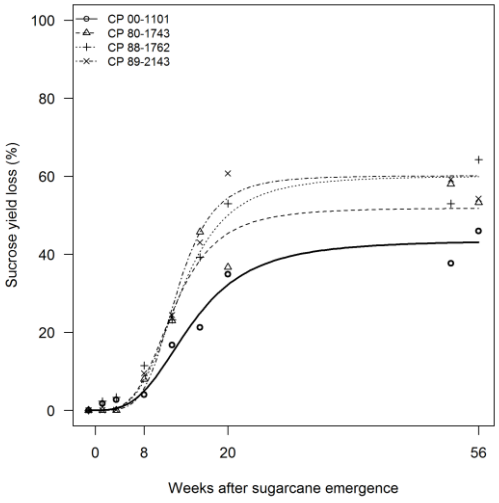
Critical Timing of Fall Panicum (*Panicum dichotomiflorum*) Removal in Sugarcane

Dennis C. Odero, Mathew Duchrow, and Nikol Havranek*

molibles, de caña, y de sucrose disminuyeron al aumentar la duración de la interferencia de *P. dichotomiflorum*. La interferencia de *P. dichotomiflorum* durante toda la temporada resultó en pérdidas de rendimiento de 34 a 60%, 34 a 62%, y 44 a 60% de tallos molibles, caña, y sucrose, respectivamente. El momento crítico para le eliminación de *P. dichotomiflorum* con base en AYL de 5 y 10% de tallos molibles fue 5 y 9 semanas después de la emergencia (WAE) de la caña de azúcar. A 5 y 10% de AYL, el momento crítico de eliminación de *P. dichotomiflorum* varió desde 5 a 9 WAE y 6 a 8 WAE para la pérdida de rendimiento de caña y sucrose, respectivamente. Estos resultados muestran que *P. dichotomiflorum* compite con la caña de azúcar, temprano durante la temporada de crecimiento, lo que demuestra la necesidad de controlar esta maleza a tiempo, temprano en la temporada, para reducir sus efectos negativos sobre el rendimiento.







Weed management in Florida sugarcane

- Weed management in Florida sugarcane uses a combination of different methods
  - Prevention
  - Eradication
  - Control

Weed management: prevention

- Keeping weeds out of sugarcane fields
- Accomplished by
  - Field sanitation
  - Control of volunteer weeds
  - Planting clean seed cane or certified rotational crop seed
  - Cleaning field equipment
  - Scouting for new infestations, spot treatments
- When properly employed, greatly reduces weed problems



Weed management: eradication

- Complete elimination of all living plants including their vegetative propagules and seeds
- Justified only for the elimination of perennial weeds in limited areas in sugarcane fields using mainly glyphosate
  - *Sorghum almum*
  - *Pennisetum purpureum*
  - *Panicum repens*

Weed management: control

- Process of limiting weed infestations and minimizing weed competition in sugarcane fields
  - **Goal**: have minimal effect of weeds on sugarcane growth and yield
- Degree of control is a matter of **economics**, the balance between **cost of control** and **sugarcane yield loss**
- Methods of weed control
  - Mechanical/physical
  - Cultural
  - Chemical

Weed control: mechanical

- **Cultivation** conducted before planting during field preparation to
  - Control emerged weed seedlings
  - Destroy residues from the previous crop
  - Aid in soil aeration and water infiltration
- Important especially when preemergence herbicide use is limited due to dry conditions associated with sugarcane planting and harvesting in Florida

Weed control: mechanical

- Cultivation when weeds are not present is not recommended because it can
  - Encourage germination of additional weed seeds
  - Remove the layer of herbicide present when soil-applied herbicides are used
- In ratoon crops, mechanical cultivators must
  - Cut through surface debris and thoroughly mix the soil
  - Be between row middles and not over the row

Weed control: cultural

- **Crop rotation**
  - Allows for breaking of weed life cycles
  - Allows for rotation of herbicides and other weed control programs
    - Leafy green vegetables, sweet corn, snap bean, radishes, rice
- **Bare fallow period** has effectively been used to manage troublesome perennial grasses (*Cynodon dactylon*)
  - Using multiple cultivation & glyphosate application


Snap beans


Rice


Sweet corn

Weed control: cultural

- Fertilizer placement
  - Placing the fertilizer where sugarcane and not weeds has access allows the cane to be more competitive
    - Banding reduces competitiveness and population density of weeds
- Selection of sugarcane cultivars that have quick canopy closure

Weed control: chemical

- Useful and economical tool in sugarcane production
- Must be incorporated into an overall management plan to obtain maximum benefit
- Application
  - Preemergence (PRE)
  - Postemergence (POST)
  - POST-directed
- Sprayer calibration is important before herbicide application

Weed control: herbicides

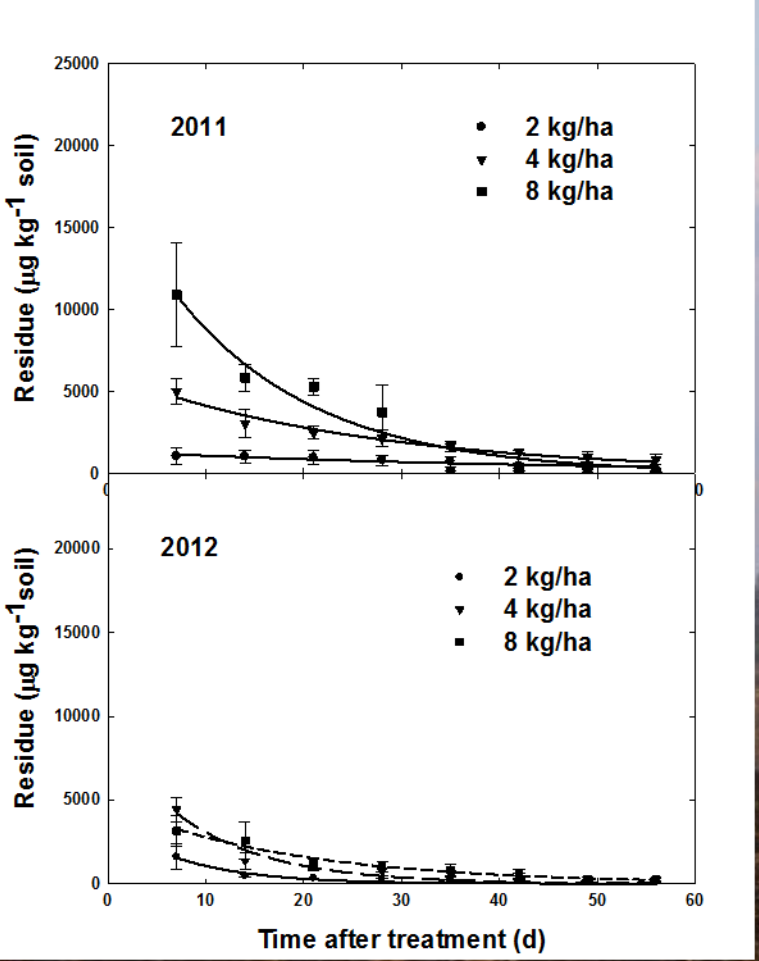
Preemergence

- Atrazine
- Metribuzin
- Pendimethalin
- *S*-metolachlor *

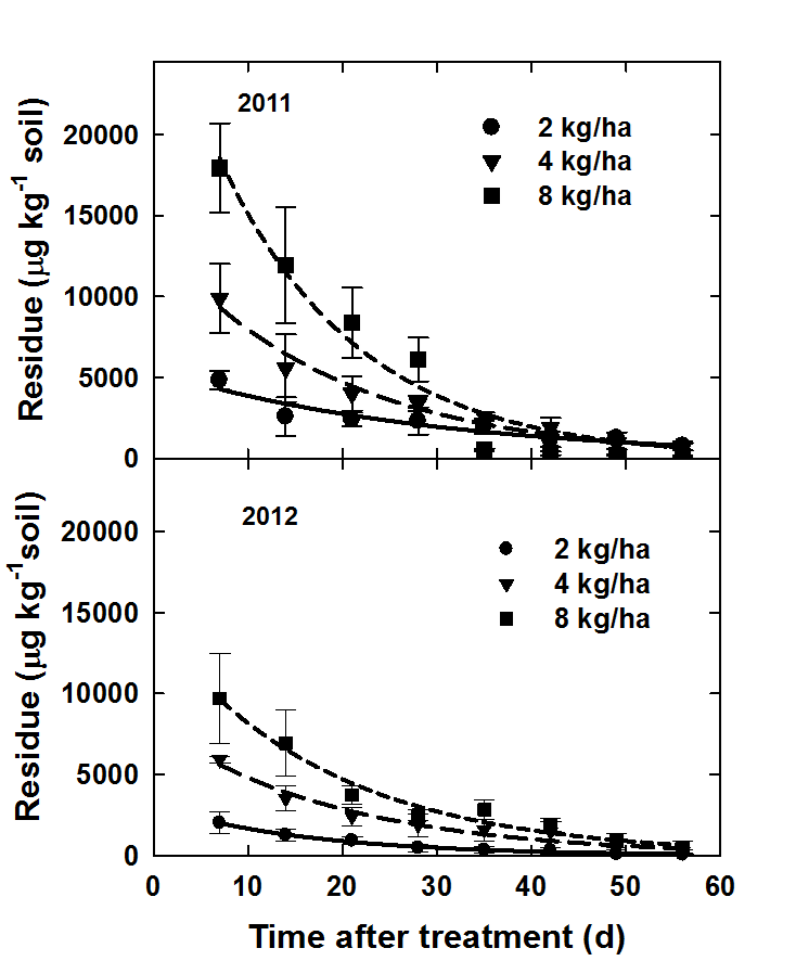
Postemergence

- 2,4-D amine
- Dicamba
- Ametryn
- Atrazine
- Metribuzin
- Mesotrione
- Topramezone*
- Asulam
- Halosulfuron
- Trifloxysulfuron

Preemergence herbicides: pendimethalin



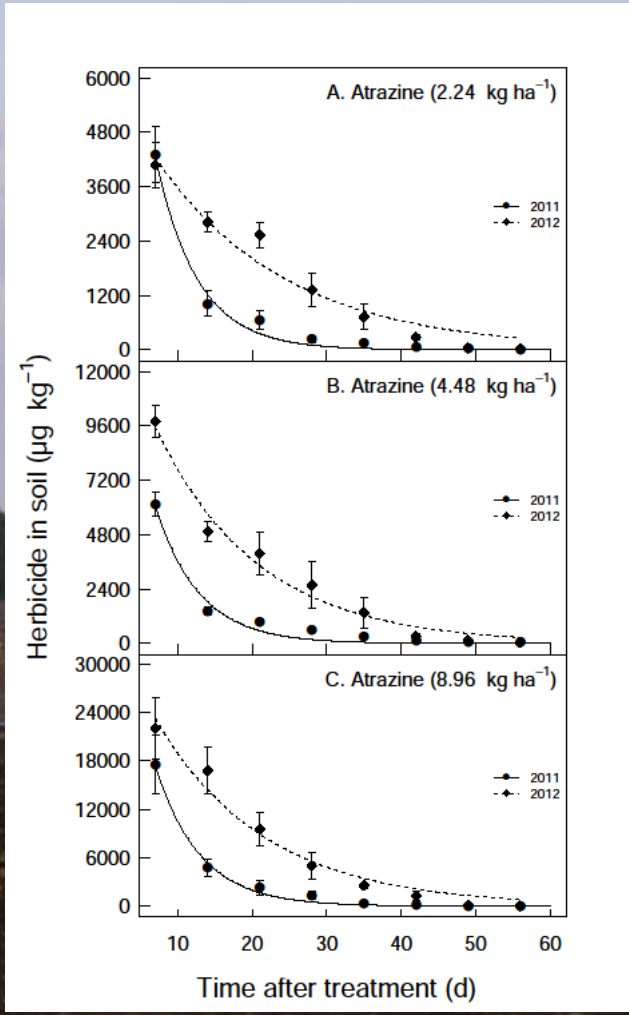
Dissipation of oil-based pendimethalin



Dissipation of water-based pendimethalin

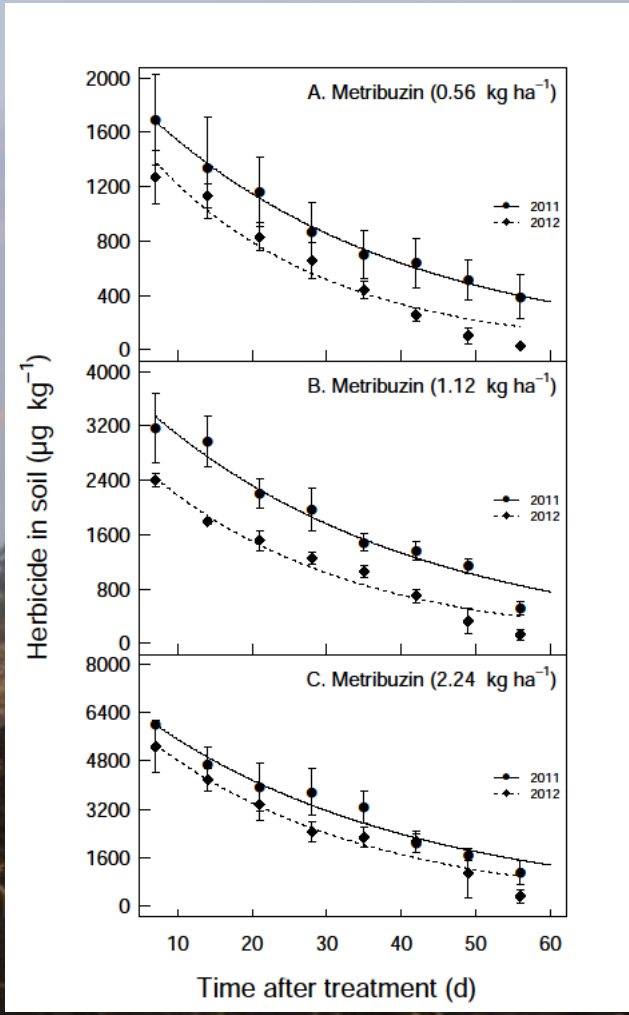
Odero & Shaner (2014) Weed Technol. 28:82-88

Preemergence herbicides: triazines



Dissipation of atrazine

DT_{50} 4-10 days



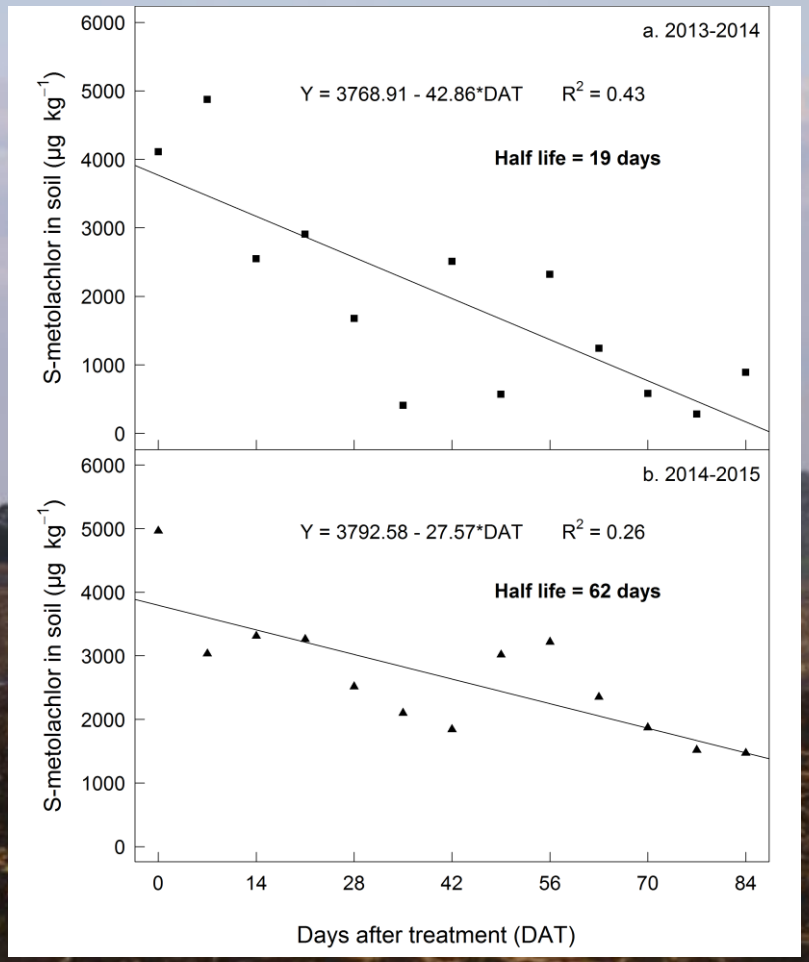
Dissipation of metribuzin

DT_{50} 19-24 days

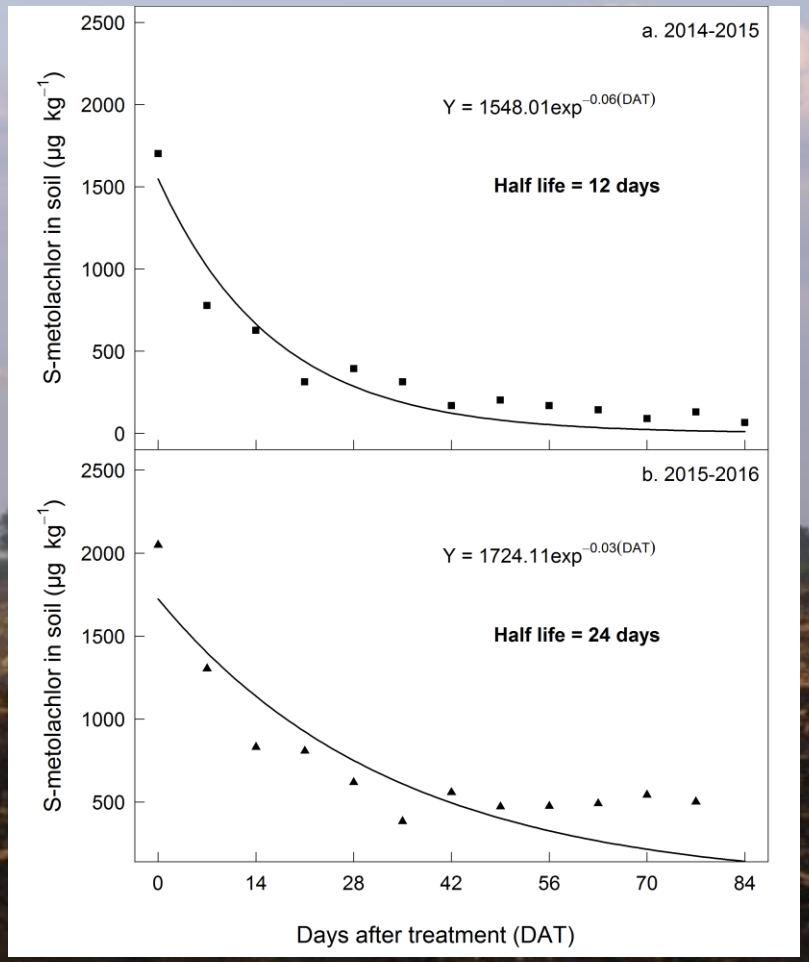
Odero & Shaner (2014) Weed Technol. 28:578-586

Preemergence herbicides: *S*-metolachlor

Organic soil



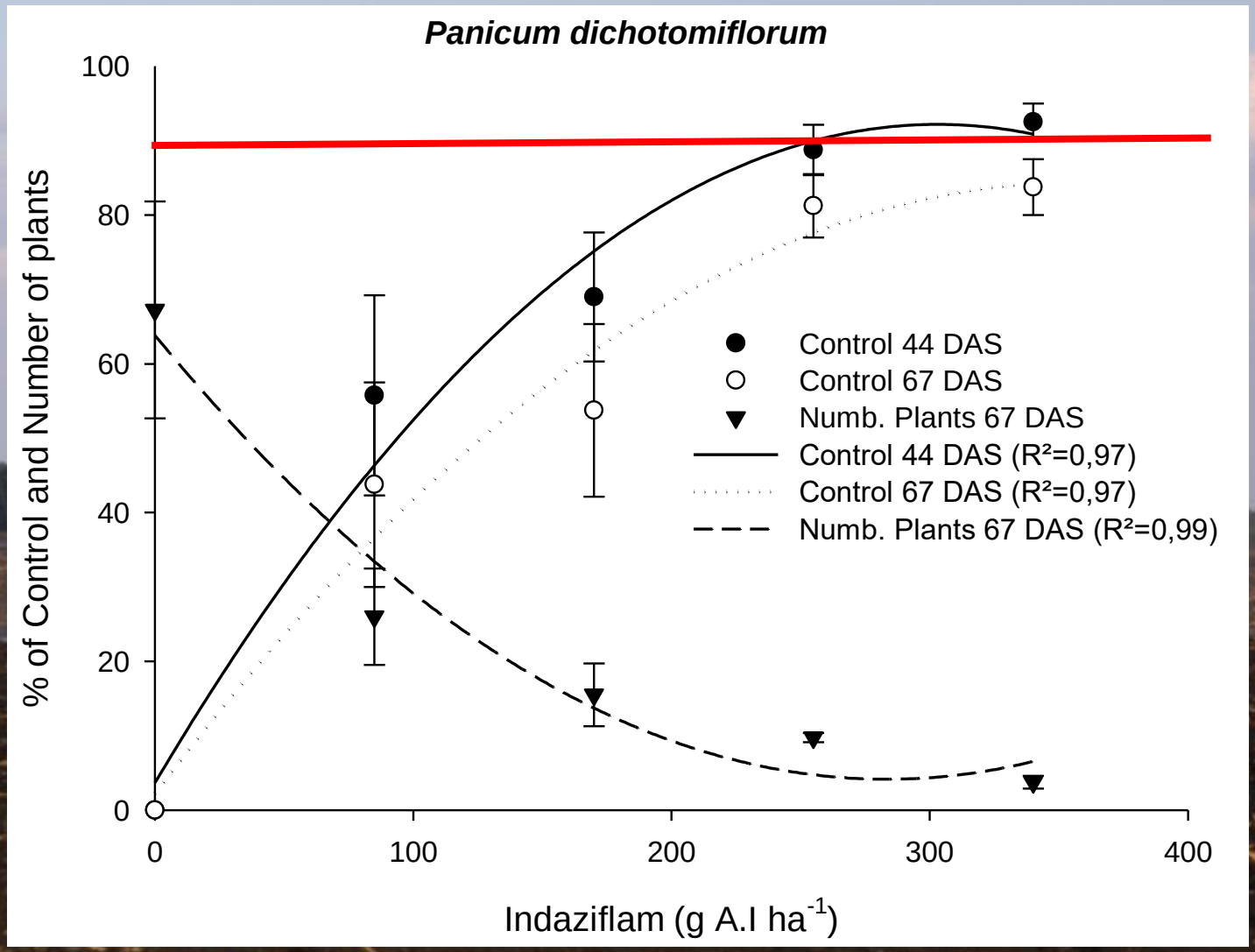
Sandy soil



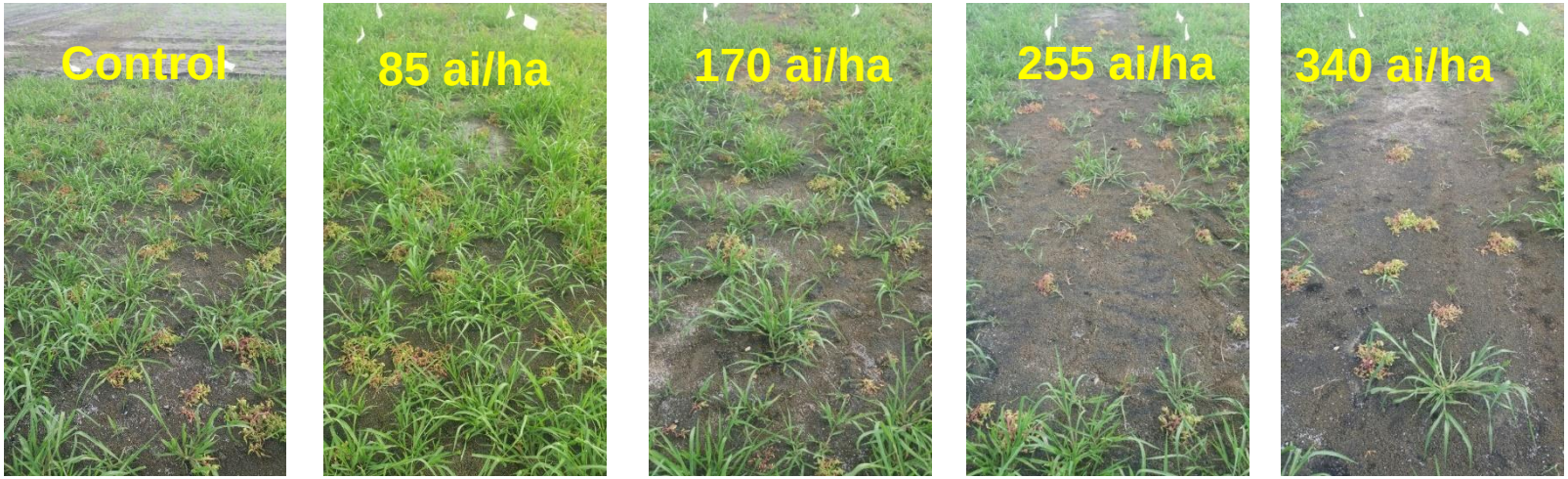
Fernandez et al. *In preparation*

Preemergence herbicides: Indaziflam

Preemergence herbicides: Indaziflam

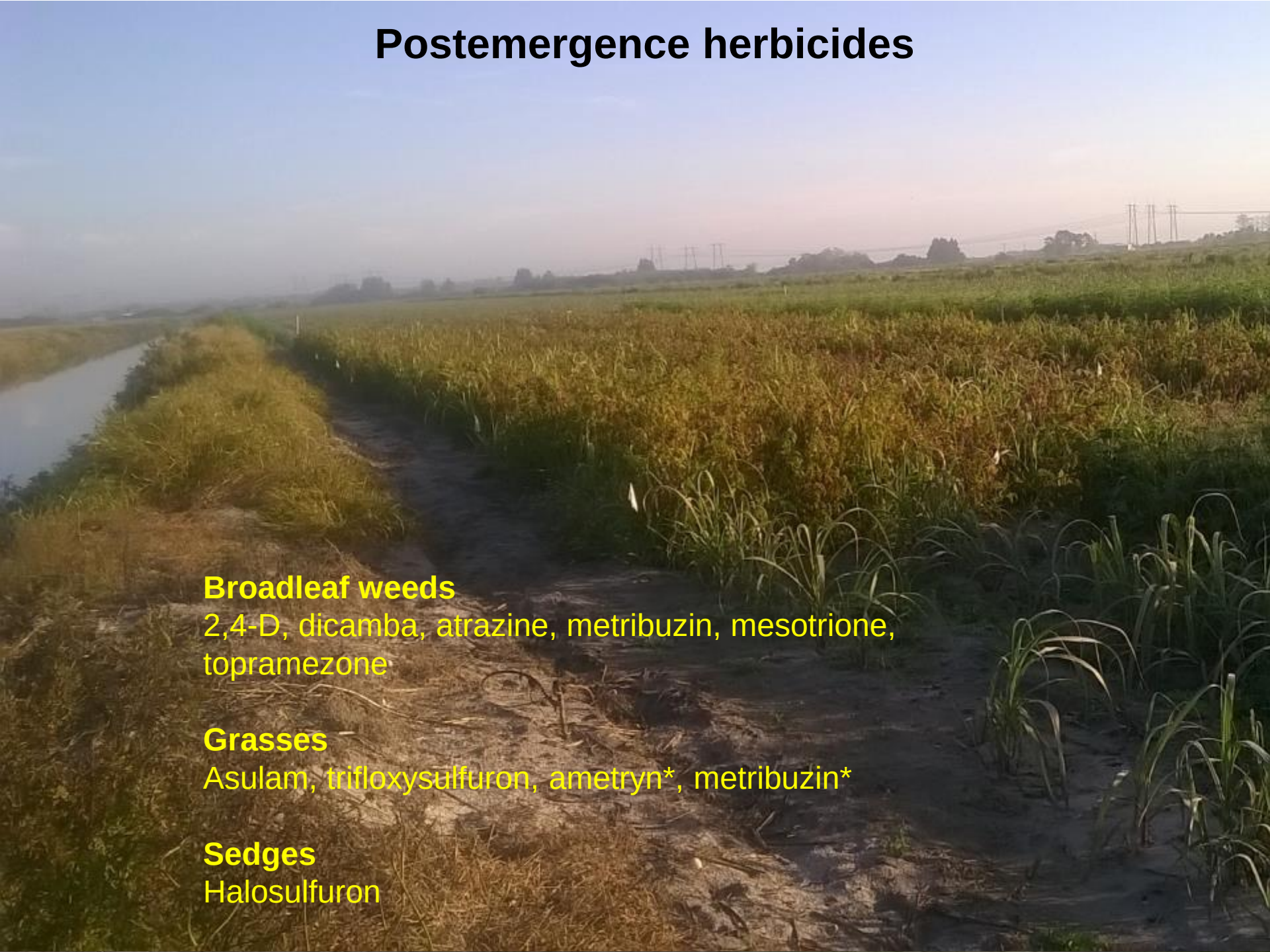


Indaziflam (44 DAT)



Indaziflam (67 DAT)

Postemergence herbicides



Broadleaf weeds
2,4-D, dicamba, atrazine, metribuzin, mesotrione, topramezone

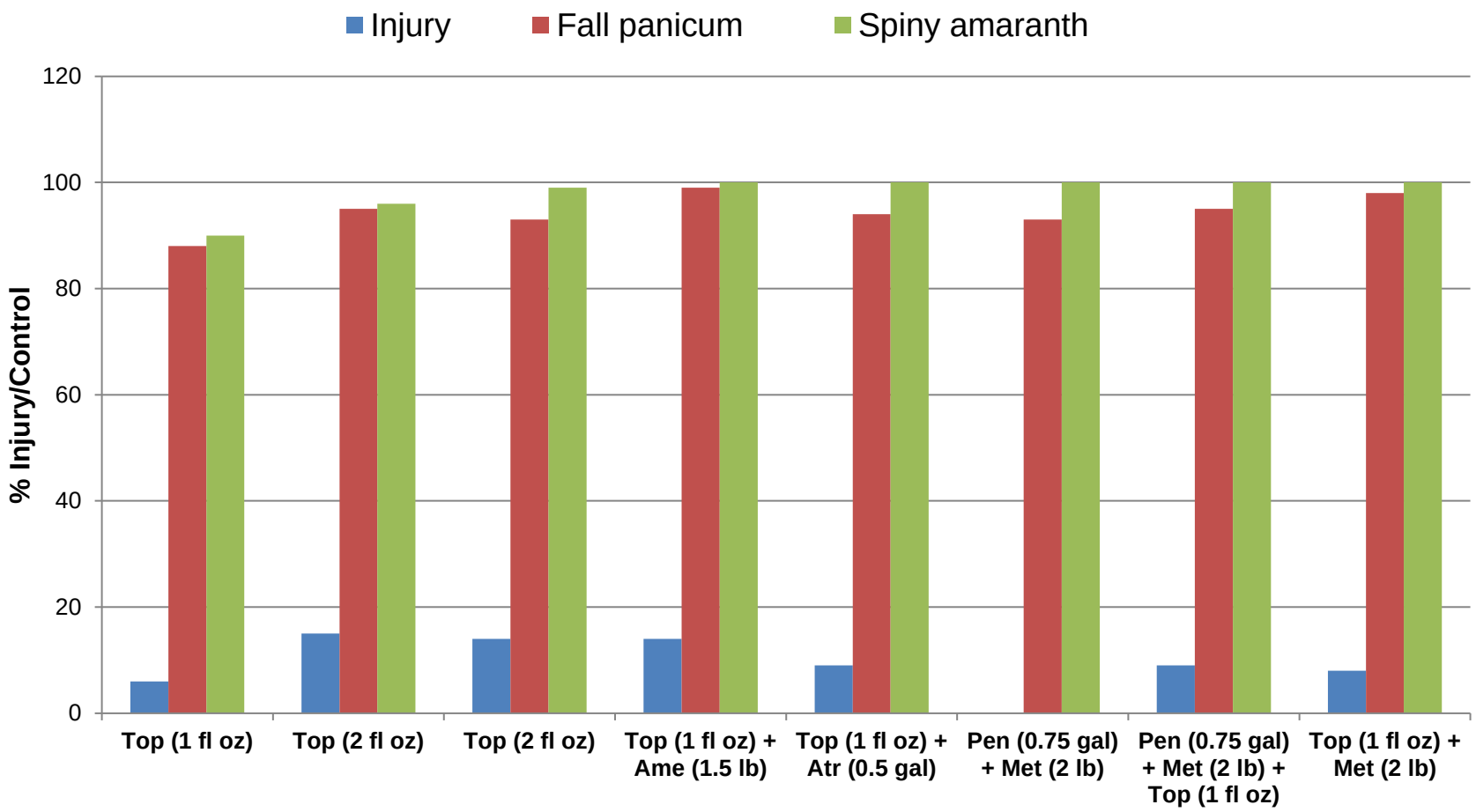
Grasses
Asulam, trifloxysulfuron, ametryn*, metribuzin*

Sedges
Halosulfuron

Topramezone

- POST annual broadleaf and grass control in corn
- Inhibits carotenoid biosynthesis (HPPD-inhibitor Group 27)
- Efficacy increased with low rates of PS II inhibiting herbicides

Topramezone: 14 DAT



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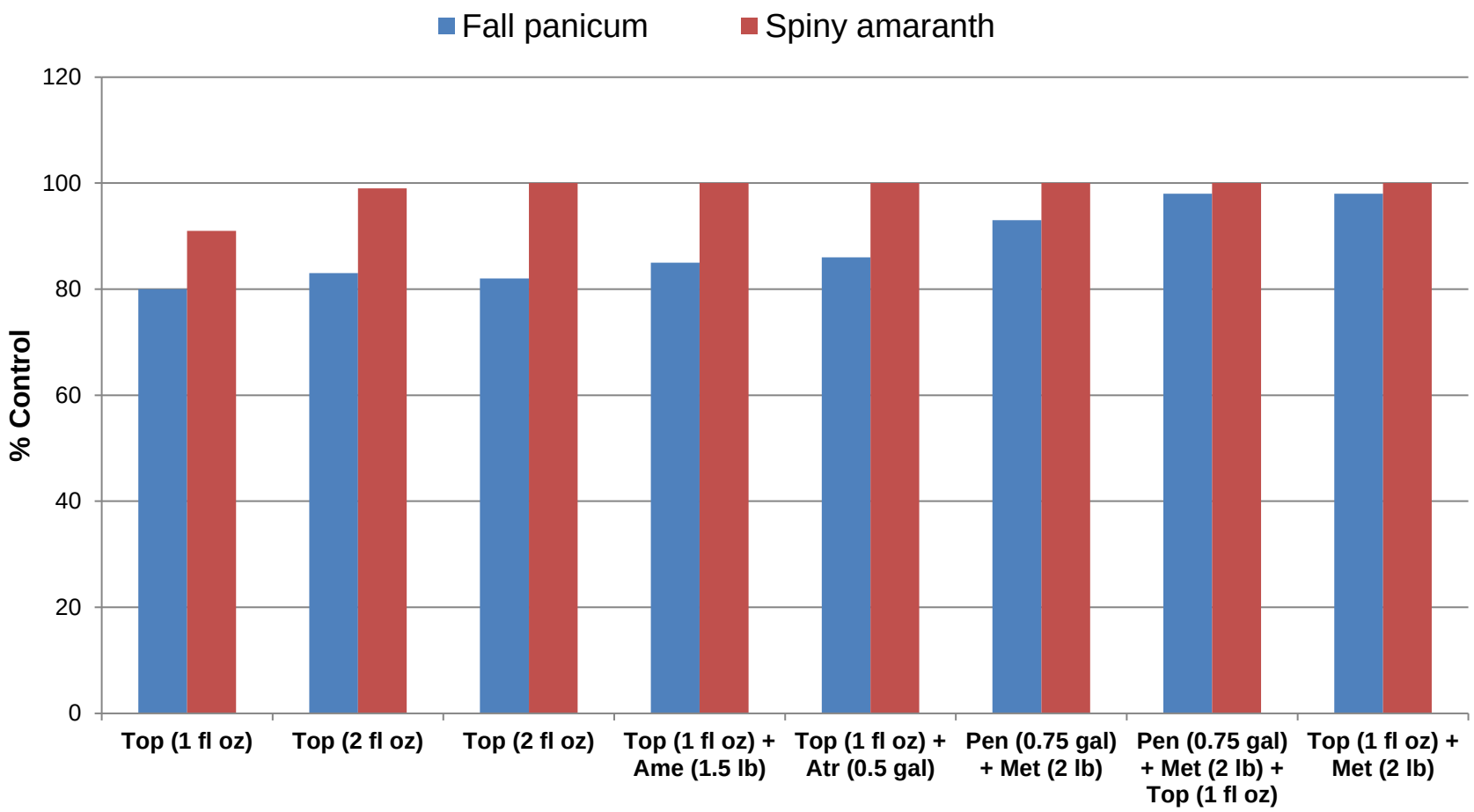
Topramezone: 42 DAT



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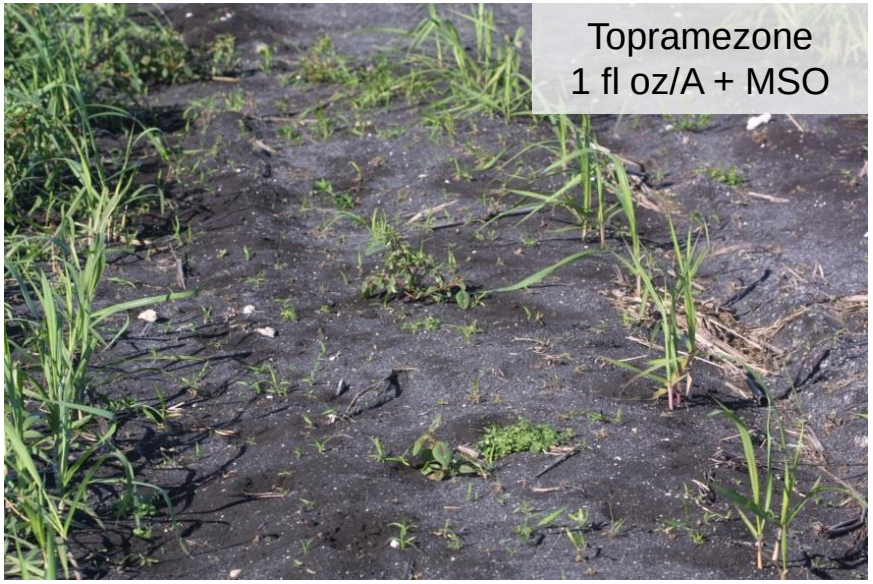
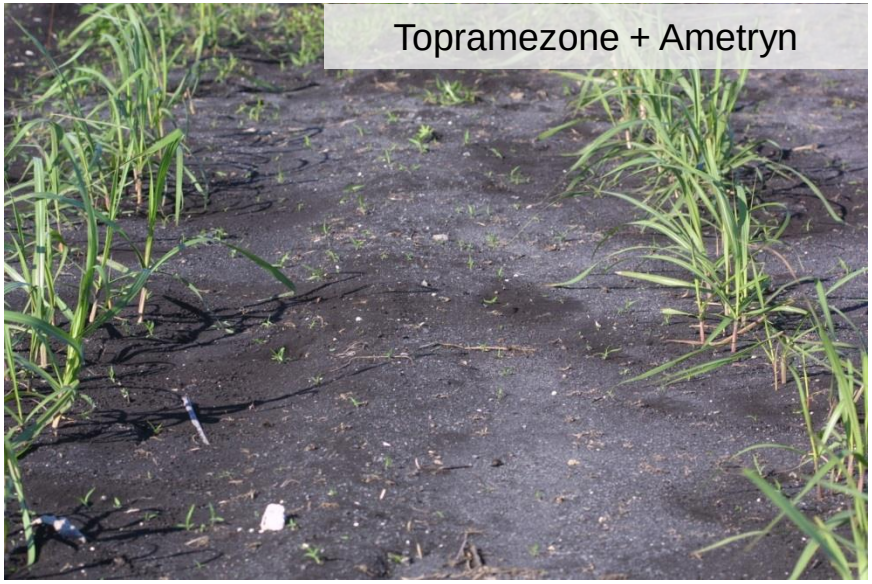
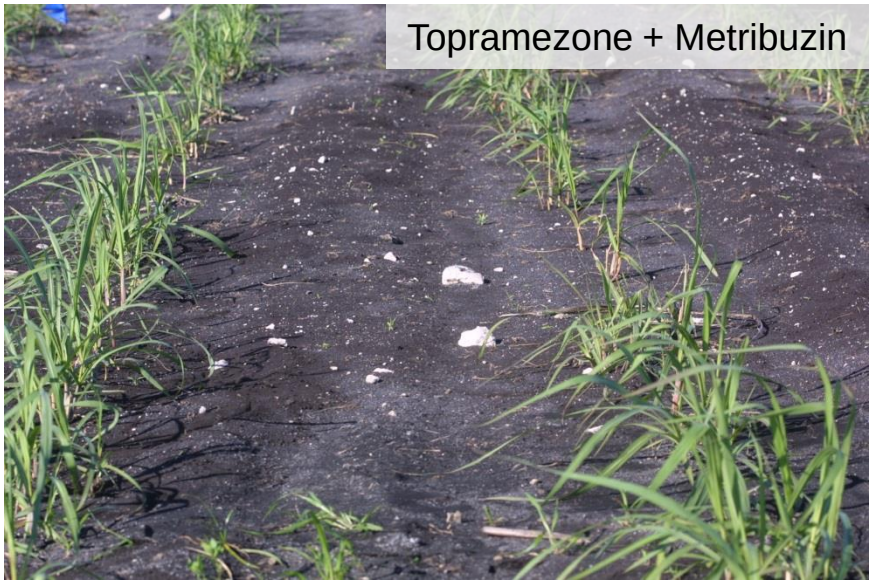


42 DAT

Topramezone + Ametryn



Topramezone + Metribuzin



Topramezone + Atrazine

Topramezone + Pendimethalin + Atrazine

42 DAT

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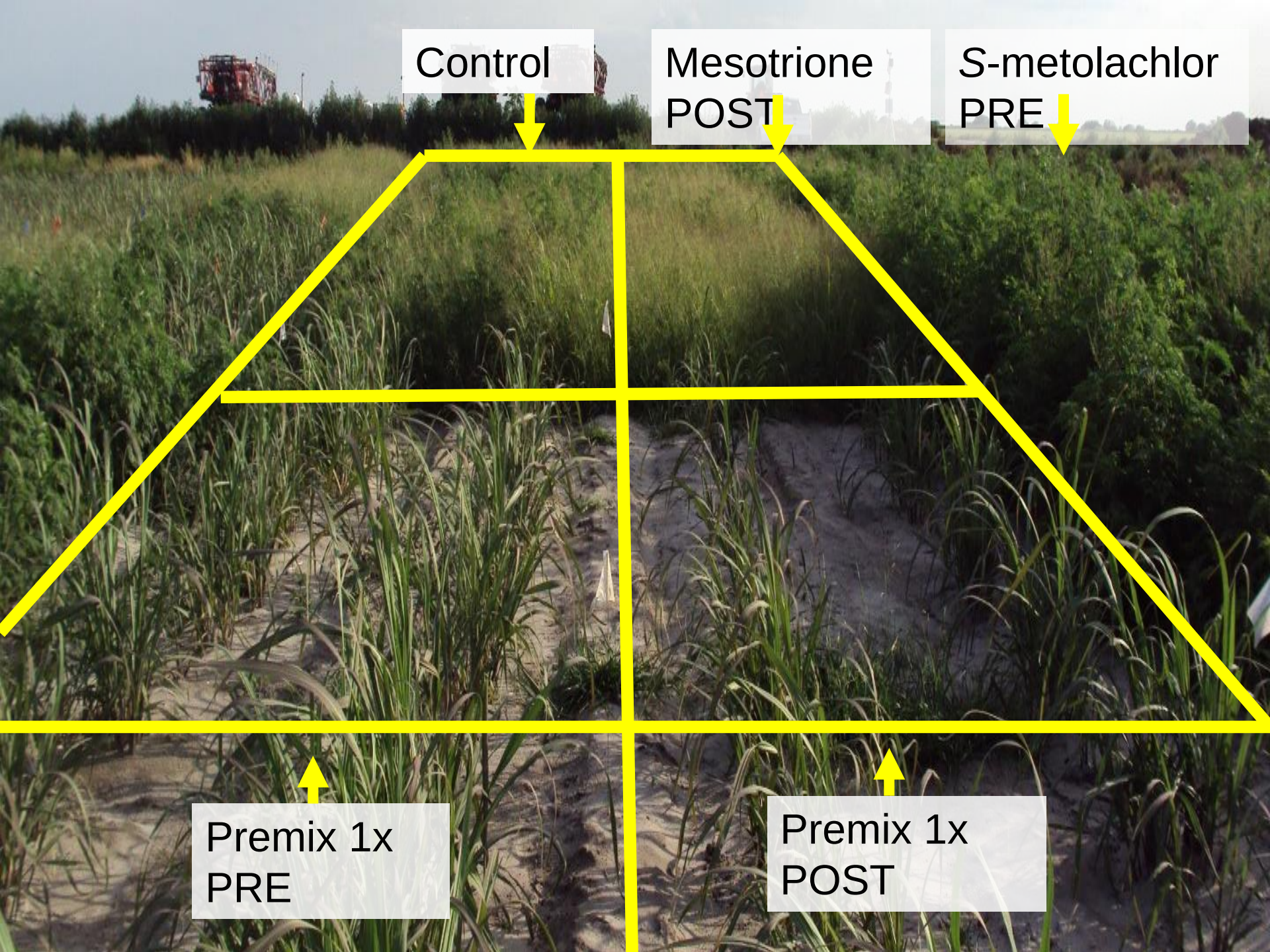
Lumax

- A commercial premix of
  - Atrazine + Mesotrione + *S*-metolachlor
- PRE or early POST
  - Control of fall panicum & other weed species


Control
Mesotrione
POST
S-metolachlor
PRE
Premix 1x
PRE
Premix 1x
POST

Integrated Weed Management (IWM)

- Development of a weed management program using a combination of preventive, cultural, mechanical, and chemical practices
- Applying the principles of IWM
  - Minimize overall economic impact of weeds
  - Reduce environmental impacts of herbicides
  - Provide optimum economic returns
- Development of IWM program is based on a few general rules that can be used on any field

2. Help the crop compete against weeds

- Several things can be done to give the crop an advantage over weeds
  - Fertilizer placement
  - Competitive varieties

3. Keep weeds off balance

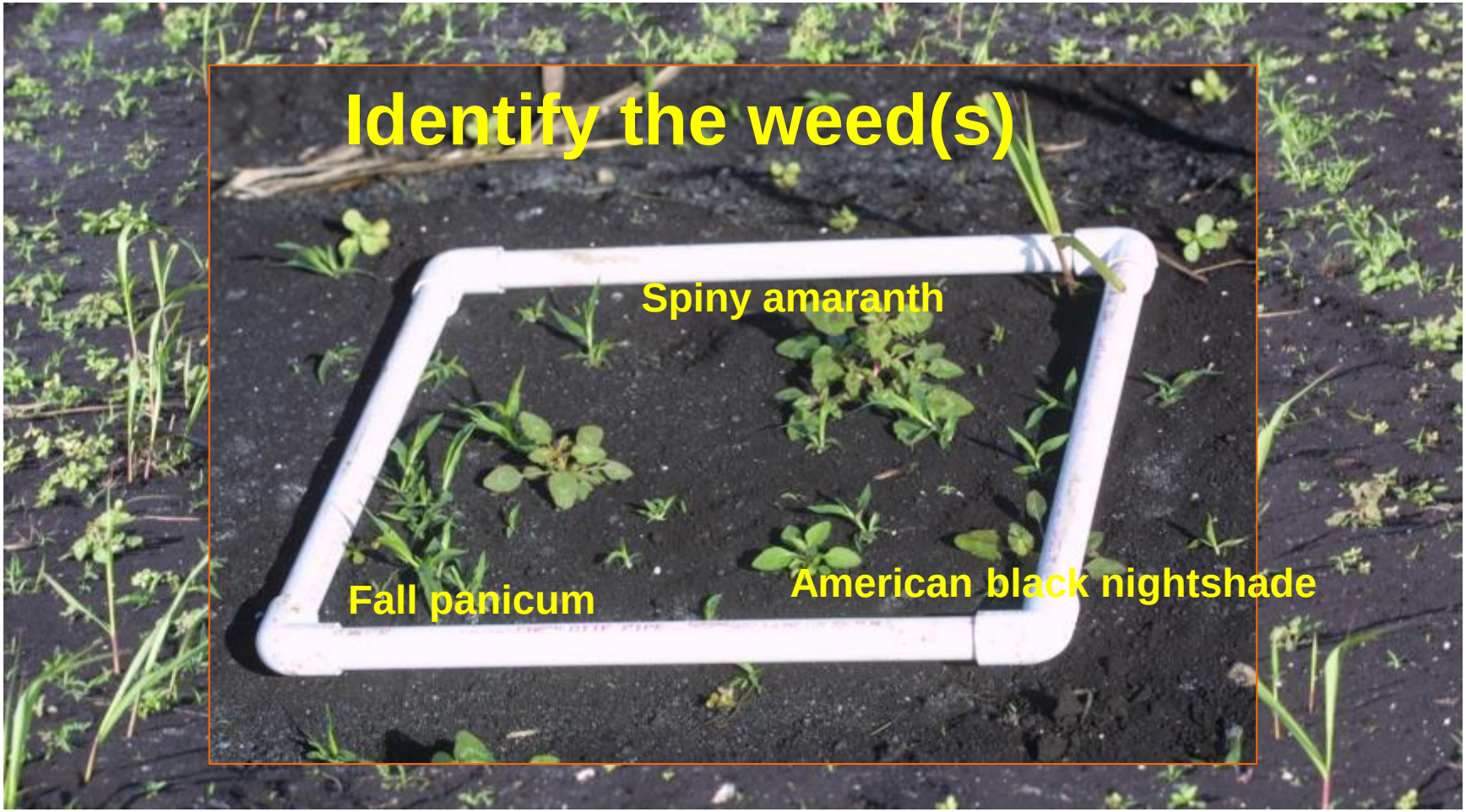
- Don’t give weeds a chance to adopt
  - Crop rotation



4. Making a control decision

- Scout your field to assess the type and number of weeds to help determine adequate spray operation and any other control measure
- Economic threshold – level of weed infestation at which the cost of weed control equals the increased return on the crop yield
- Consider the cost of delaying weed control

What constitutes an effective weed management program?



What constitutes an effective weed management program?

- Identify the weed(s)
- Select proper control measure(s)
- Use an integrated approach (use multiple tools)
- Implement the program
- Document and keep records
  - Field history
  - Cropping practices

Remember for chemical weed control

- Do it right
  - Proper herbicide(s)
  - Proper herbicide rate(s)
  - Proper placement of material
  - Proper time of application
  - Proper manner of application
- READ THE HERBICIDE LABEL